RAILROAD GAZETTE

FRIDAY, FEB. 16, 1894

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Contributions.

Tests of Hyatt Roller Bearings.

NEWARK, N. J., Feb. 12, 1894.

TO THE EDITOR OF THE RAILROAD GAZETTE:

The following tests, obtained from the apparatus described in the article on the Hyatt roller bearing on Feb. 2 are sent in correction of those published. Three Pennsylvania Railroad bearings were first tested, after they had run for several weeks; and then three Hyatt roller bearings were substituted and subjected to the same tests. The 297 lbs. at the start of the Pennsylvania Railroad bearings was obtained after the bearings had stood at rest for seven minutes. WALLACE M. HILL.

TEST OF ORDINARY AND ROLLER BEARINGS.

	Diam. of pulley,	Rev. per min.	Pressure in tons.	Force of friction.	H.P.
P. R. R.:					
Start	24 in.	197	4	297 lbs.	11.20
Moving	24 "	197	4	17 "	1.27
Hyatt:					
Start	24 "	197	4	8 "	1.27
Moving	24 "	197	4	7 "	0.52

Carelessness in Counterbalancing Locomotives.

TO THE EDITOR OF THE RAILROAD GAZETTE:

It seems to me that a word is needed on the subject of locomotive counterbalancing. It has been my experience that defects or variations in balancing driving wheels occur oftener through carelessness than from the rules in force at the different shops. I have found in numerous cases where the spokes and counterbalancing space were cored that no lead whatever was used, and the plates scarcely balanced the weight of crank pins and crank pin hubs, to say nothing of other revolving and reciprocating parts. In a few other cases I have found that the balancing weight used was the same in main and back wheels in engines with four driving wheels. I have also found in coring for space for counterbalancing that the foundry often does very poor work, so that sufficient space would not be left in one center when filled with lead to properly counterbalance the weights, while in the opposite wheel the space could not all be utilized. It would seem that few, if any, of the locomotive builders pay proper attention to counterbalancing. When the counterbalancing is cast solid in centers, they are very liable to weigh largely under or over the proper amount. DRIVERS.

Erie Bondholders' Interests.

NEW YORK, Feb. 13, 1894.

TO THE EDITOR OF THE RAILROAD GAZETTE:

In your article on the Erie reorganization in the issue of Feb. 9 you omitted to state that the stockholders propose to keep alive the old mortgage of 33 million after the bonds have been exchanged for the new five per cents. In some future reorganization of this company (which, in the writer's opinion, will surely come) the power is given to the stockholders as owners of a majority of the consolidated six per cents. to foreclose that mortgage and wipe out entirely the proposed new 70 million of five per cents. There is only one way to deal with this matter, and that is for the bondholders to foreclose, instead of waiting for the stockholders to do so when the next default occurs. The holders of the consolidated six per cents. by exchanging their bonds or the new five per cents. throw themselves into the stockholders' hands, to do with them, at some future time, as they may see fit. F.

[Our correspondent has been misled. Old seconds when exchanged for new bonds, on the plan being declared operative, will be stamped "held for account of new bonds"; and when all are exchanged this old mortgage will be satisfied of record or else deposited with the trustee as additional security for the new mortgage. Stockholders will not own the defunct bonds and cannot foreclose as our correspondent fears.—EDITOR RAILROAD GAZETTE.]

The Meneely Tubular Bearing.

WEST TROY, Feb. 7, 1894.

TO THE EDITOR OF THE RAILROAD GAZETTE:

In the article describing the Hyatt roller bearing, published in your issue of 2nd inst., you unintentionally do injustice to the Meneely tubular bearing by the opening statement that "all of the various (roller bearing) devices have so far met a common fate."

The eight years of uninterrupted study and practical experiments which we have devoted to the problem of diminishing journal friction has brought forth the fact that the substitution of rolling for sliding friction on the journals of railroad cars not only can be, but has been successfully accomplished—a result rendered possible, in our judgment, by the comparatively recent production of heavy weldless steel tubing. A device which, as compared with the fixed brass bearing, eliminates over 90 per cent. of initial frictional resistance; which, under a 50,000-lbs. passenger car, has run over three years with a record of 125,000 miles without having caused any measurable wear upon itself or the journal, and which is still running; which has operated a train of four passenger cars, weight 204,000 lbs., for the last 18 months, making 70,000 miles without the slightest wear, and which, by careful official test, enables the train to be run with 25 per cent. less fuel; which has operated many electric motor cars for more than two years, and is to-day under 90 cars of the dividend-paying electric roads of Troy and Albany—on both of which it has been adopted as the standard journal bearing—such a device, we think, is day by day approaching the plane of a mechanical necessity rather than the abyss wherein all discredited devices are sharing a common fate.

MENEELY BEARING CO.,
Geo. R. Meneely, President.

Patenall's Block Signal Apparatus.

RAHWAY, N. J., Feb. 7, 1894.

TO THE EDITOR OF THE RAILROAD GAZETTE:

As inquiries are numerous as to the comparative merits of the Sykes block system with my improvements, manufactured by the Johnson Railroad Signal Company, and that made by the Union Switch & Signal Company, it may be well for you to lay before your readers what I have to say on this subject. . . .

Co-operation is one of the essential features of the Sykes system. I claim that this is carried out to perfection in the latest instrument manufactured by the Johnson Company, and in service on the New York, New Haven & Hartford. It is accomplished by a twice normally broken circuit, and an arrangement in the instrument by which the operators must act in simultaneous unison with each other in sending and receiving a release. The advantages secured by this arrangement are: 1. Open line wires can be used with absolute safety, only three of which are required. 2. Any foreign current is detected with certainty. 3. A cross can result in nothing worse than a failure to release.

In the Union block system, co-operation is secured by the use of two circuits, requiring the action of both operators to secure a release, but not in simultaneous unison with each other. This arrangement is open to the objection that insulated line wires must be used (four are required) and maintained in perfect condition to avoid serious results. Under the most careful maintenance unless renewed every few years the insulation becomes impaired. Apart from additional cost, defects in insulation make the following disastrous results possible: 1. A foreign current would release without detection, because operators act independent of each other. 2. Under certain conditions a cross would effect a release with a train in section.

In my system the batteries are divided and so arranged that a failure affects only the particular circuits which they control. In the Union Sykes system the batteries are so arranged that should a failure occur it affects the whole of the circuits; a release can neither be given nor received in or from either direction. My system is carried out on the true principle of block working—the affirmative. This cannot be said of the Union Switch & Signal Co.'s Sykes. T. H. PATENALL.

Rate Cutting as Seen by Daylight.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Of course traffic and other railroad men have known about the rate cutting which has always played a prominent part in railroad affairs, but outside observers have found it not easy to measure the extent of the evil. One or two recent events have, however, thrown some light on the subject, and shown it up in a way that may warrant a remark or two in your columns.

A press dispatch from Buffalo tells of a case which was brought out by a lawsuit there last week. The Jacob Dold Packing Company, of that city, hired a man named Parks to get rebates for it, his ostensible occupation being "transportation agent." He testified that he succeeded in obtaining rebates or commissions of $4 for each single deck and $6 for a double deck car of hogs from Kansas City to Buffalo via the Toledo, St. Louis & Kansas City; and the New York Central paid 3 cents per 100 lbs. on carload lots of provisions from Buffalo to the seaboard. The packing company discharged Parks, and he then sued for his salary; so the facts came out. The judge held that a contract to get unlawful rebates was illegal, and that the clerk could not recover. The New York Central rebate probably had to do with intra-state traffic, and was therefore not a violation of any specific law (though it was, of course, contrary to public policy, and therefore wrong), but the judge seems to have lumped the two cases together in his decision as to illegality.

Another case which has become well known is that of the Lake Shore road. President Newell is reported to have said that his road always cut rates when its competitors did—a policy well known, but not always so plainly avowed. Some prominent roads in the hands of receivers have announced very low open rates for the reason that the receiver was afraid the courts would not approve the payment of such large amounts of rebates as were accumulating.

It is not my intention to bring forward in this brief note any patent plan for preventing rate cutting. I may say that I do not agree with some of my sanguine friends as to the extreme hopes which they seem to cherish about the maintenance of rates, if, for example, the anti-pooling clause of the federal law were repealed. I am in deadly opposition to that part of that law, for reasons known generally among railroad men, but I do not shut my eyes to the other fact that rate cutting is partly due to commercial causes, to the decline in prices of staple products, to dullness of trade here and abroad, to the increasing number of gateways by which any particular territory can be entered and its agreements violated without technical guilt, and lastly by the desperate attempts to keep up round-about routes as against direct lines. Under these conditions, with no prospect of a modification of the harsh interstate law, and with no confidence to be placed in managers' words of honor, I must confess that I am a pessimist on the subject of values for railroads' bonds and stocks, except the very best; nor am I sure that I know really which the best are.

The point which I started out to make is therefore this: If things are really worse than they seem on the surface (which I believe to be the fact); if reports of gross earnings are deceptive and misleading; if roads are kept from insolvency only by borrowing money to make up deficiencies which should be met from operating revenue; if, in short, the situation is really dangerous to investors and railroad men alike, then it is time that influential men should make a clear statement. We cannot expect a remedy until people understand the desperate nature of the case; and who is to tell them? Must things go on until another fifth of our railroad mileage goes into the hands of receivers? I am lifting my humble voice and crying in the wilderness in the hope of seeing a change of heart on the part of leading railroad men; but I am more likely to suffer the fate of John the Baptist. But I hold that the railroad situation is dangerous to all interests concerned. If I am right in this opinion, we should have heroic remedies. Who will confess the truth, startle the community by telling that truth, and thus pave the way for a genuine reformation? A PROPHET OF EVIL.

The Association of Air-Brake Men.

TO THE EDITOR OF THE RAILROAD GAZETTE:

The Association of Railway Air-Brake Men is new, and wishes the recognition and support of the superior railroad officers, and there appears no better way of obtaining the same than through your paper. The Association was organized at Pittsburgh last June with a charter membership of 16. It now has 62 members. The first annual meeting will be held in Columbus, O., April 10. The Board of Trade rooms have been secured for the convention, and reasonable rates at the several hotels have been obtained for the visiting members.

All of the older and larger mechanical organizations deal with air-brake subjects in their conventions, but the attention to details, which makes up a perfect air brake service, is still lacking. Article II., Section I., of the constitution says: "The object of this Association shall be to adopt a uniform method of instruction and maintenance in the use of air-brakes on the various railroads, which will enable them to be worked to their maximum efficiency." While the older organizations have drafted rules governing instructions, etc., they have done comparatively nothing toward the maintenance of brakes, especially on freight cars.

There are two classes of members, active and associate, and any person having a thorough practical knowledge of the operations and construction of air-brakes, and in the employ of a railroad corporation, may become an active member. Persons otherwise employed may become associate members, and be entitled to all of the privileges of an active member, except holding office. The range of eligibility is very wide. The Traveling Engineers admit an air-brake expert, but many are denied admission to that body who can belong to the association of Air-Brake Men.

The air-brake business is an art in itself, and cannot receive the attention due it by combining it with some other business, especially if it has to be the tail of the dog. The air-brake man is as much devoted to the interests of air brakes as other men to their business, and is not content to sit for a day or two in a convention and listen to discussions of topics having little or no interest for him, awaiting the time for the introduction of air brake subjects, and then, possibly, be disappointed at the few hours given to the meager discussion of his pet topic. The air-brake service is one of the most im-

portant branches in modern railroading, and must receive better attention. The number of cars being equipped with air-brakes every year is now large.

The Association is engaged in a worthy cause, and should be encouraged by officials. Much money can be saved companies by the attainment of the ends which the Association seeks. Leave of absence and transportation to attend the conventions are more difficult to obtain by the men holding memberships in this Association than by those belonging to the older and larger ones; a just consideration of this fact by officials will greatly help the Association.

The following named members have been appointed on committees by President Farmer to prepare papers to be read and afterward discussed at the coming annual convention:

Committee on Instruction.—F. M. Nellis, Westinghouse Air-Brake Co.; Paul Synnestvedt, Crane Co.; T. H. Hedendahl, Union Pacific; F. H. Cota, C., B. & Q.; H. B. Shreve, New York Air-Brake Co.

Maintenance of Freight and Passenger Brakes.—P. J. Carney, Chicago & Northwestern; H. W. Decker, Southern Pacific; W. F. Brodnax, Richmond & Danville; F. M. Nellis, Westinghouse Air-Brake Co.; S. J. Kidder, Westinghouse Air-Brake Co.

Cleaning of Triple Valves and Brake Cylinders.—Robert Burgess, Westinghouse Air-Brake Co.; B. F. Houchin, Louisville, New Albany & Chicago; J. B. Swan, P., C. C. & St. L.; M. E. McKee, Great Northern; J. A. Jessen, Louisville & Nashville.

Air-Pump Repairs.—Otto Best, N., C. & St. L.; C. A. Saunders, Missouri Pacific; H. Montgomery, Pennsylvania; W. H. Carr, P., C. C. & St. L. Robert Wark, St. L., I. M. & S.; R. N. Martin, Pennsylvania.

Handling of Freight and Passenger Trains.—S. D. Hutchins, C., C., C. & St. L.; C. B. Conger, C. & W. M.; F. B. Farmer, Westinghouse Air-Brake Co.; E. D. Fowler, St. L. C. & St. P.; Isaac Brown, Chesapeake & Ohio.

Blank applications for membership and copies of the constitution and bylaws may be had of P. J. Carney, Secretary, South Kaukauna, Wis.

F. M. Nellis.

Hall Signals on the Lehigh Valley.

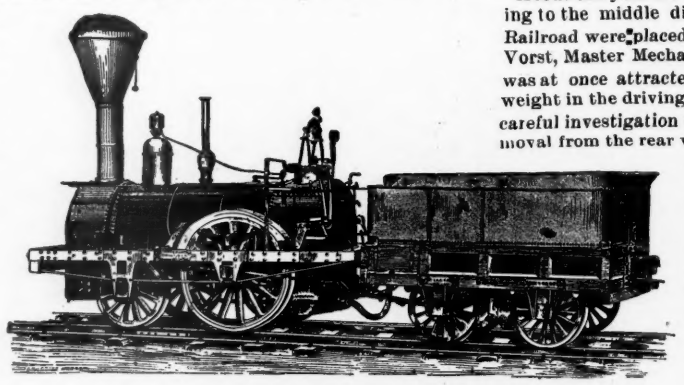
The engraving shown herewith is a conventional drawing of a section of the Lehigh Valley Railroad, between Mauch Chunk and Penn Haven Junction, Pa., which is being equipped with Hall automatic block signals. This nine-mile section is one of the most crooked portions of the Lehigh Valley road.

The signals are to be operated by the rail circuit system and they will stand normally at danger, the apparatus being connected according to Wilson's patent as shown in the *Railroad Gazette*, Jan. 13, 1893. Each signal will be cleared as a train approaches within one-half mile of it, provided the block ahead is clear and the switches are set for the main line. Each signal is provided with an overlap of about 2,600 ft., or half of the block, the blocks being about one mile long. At each switch there is also located a disk indicator which will stand normally at clear, but which will show danger when a train approaches within 2,500 ft. of the signal first back of and protecting that switch. This is intended to notify the switchman that a train is approaching or is in the block, and therefore that the switch must not be opened to let a train upon the main track from the siding or crossover. The indicator will remain at danger until the train has passed by the next succeeding signal and overlap, when it will again show clear (provided no other train is approaching) and the switchman can then let a train upon the main track, which will set the block signal at danger, and stop any train that may be approaching on the main line. All sidings are protected by the extension of the circuit through their rails to a safe distance from the main line, so that any car standing within fouling distance will cause the signal to show danger. The opening of either end of a cross over will also block the signals on each track connected thereto.

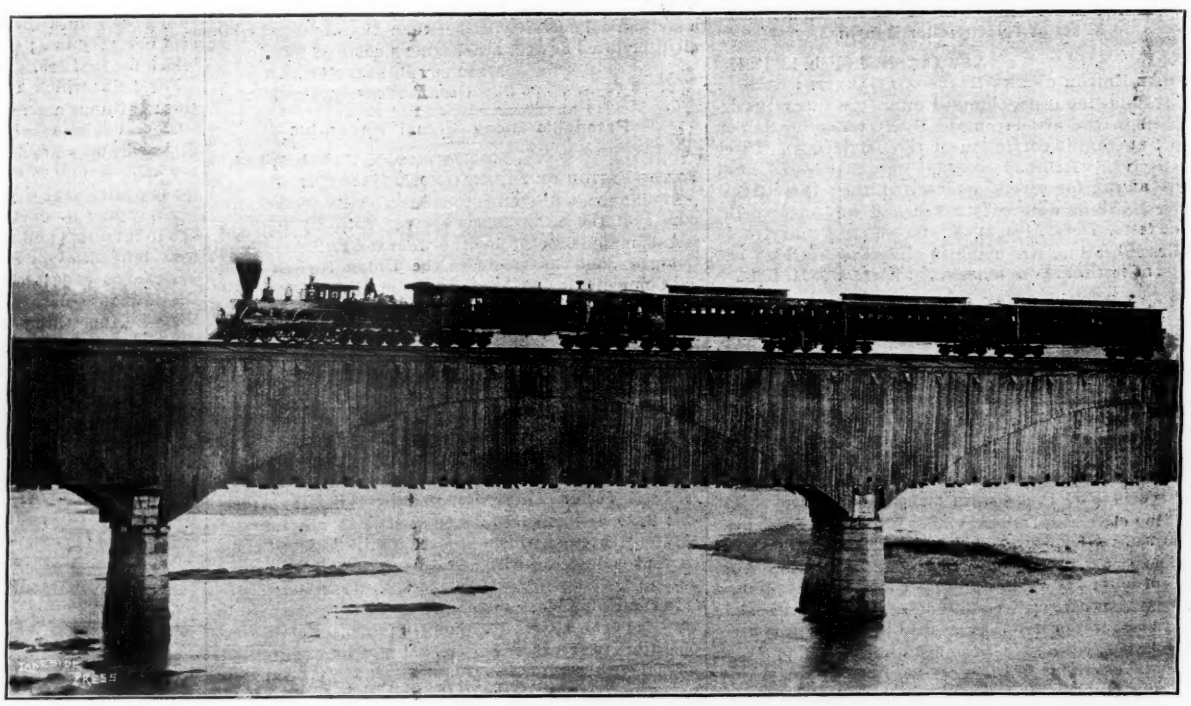
The location of the switches on the diagram is not exactly correct as to distance, but is accurate for all practical purposes.

First Locomotive in Maine.

The annual report of the State Railroad Commissioners of Maine, which has just appeared, contains some engravings made from photographs illustrating the progress made in railroading in that state since 1837. We reproduce herewith two of these engravings, one of a locomotive, the first ever run in that state, which made its first trip over the Bangor, Oldtown & Milford railroad Aug. 19, 1837, and one of the railroad bridge over the Kennebeck River at Augusta as it appeared in 1863. The locomotive was built by Robert Stephenson & Co., at Newcastle-on-Tyne, in 1835. The railroad, known as the "Veazie road," was at that time laid with wooden rails strapped with iron. The couplings between the engine and the cars were made of three thicknesses of sole leather riveted with copper rivets. This engine weighed about 12 tons.



First Locomotive in Maine, 1836.



Railroad Bridge over the Kennebec River at Augusta, Maine, 1863.

Locomotive Counterbalancing.

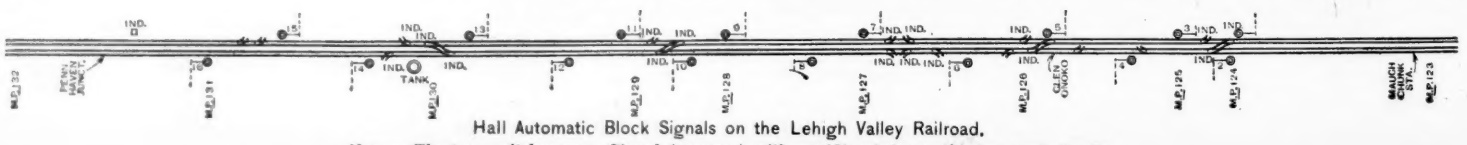
BY CHARLES SEYMOUR.

The recent experiments at Purdue University reported in the *Railroad Gazette* of Dec. 15 have induced the writer to present some of the results of fifteen years' experience with rotating and revolving bodies, together with some of the experiments and apparatus upon which his views and conclusions are based. The field of counterbalancing is one in which mechanics tread with timidity, and one in which disagreeable controversies are encountered. "The Master Mechanics' Association is said to have failed to take advantage of its opportunities for scientific investigation;" and the "American Society of Mechanical Engineers is accused of having been indifferent to railroad engineering." The Master Mechanics deserve far more credit for their work in this field than they are given, and have not been fairly consulted by those who have busied themselves in formulating the little that is known on the subject of balancing. It is true, unfortunately, that the Master Mechanics have contributed but little to the literature of the subject; but it is a mistake to assume that they have been unmindful of its importance. They have appreciated its magnitude and have always appreciated it with feelings of timidity and awe. While thus appearing irresolute some amateur mathematicians have rushed in "where angels fear to tread," dragged the whole subject out of their hands and into a realm of imagination, basing their views upon insufficient data and illogical premises.

About the year 1856 seventy-five locomotives, belonging to the middle division of the New York Central Railroad were placed under the care of Gardner B. Van Vorst, Master Mechanic at Schenectady, and his notice was at once attracted to the large amount of balance weight in the driving wheels of some of the engines. A careful investigation was begun, which led to the removal from the rear wheels, as much, in some instances as two-thirds, and from the forward wheels, about one-half, of this weight. The result was a marked improvement in smoothness of running. The theories upon which the changes were based were not known to the apprentices, the class to which the writer belonged at that time. It was enough, however, to know that Walter McQueen, of the Schenectady Locomotive Works, concurred with him. The two gentlemen were warm friends in frequent consultation, enthusiastic mechanics, studiously and mathematically inclined; and it is not to be presumed that they guessed their way through the problem or jumped at conclusions

Experience has compelled me to assume the thesis, that the reciprocating parts of an engine cannot in any degree be balanced by a counterweight in a rotating part. All that need be sought in balancing the reciprocating parts is to receive their shock on a cushion of steam or other spring; in fact, all can be done in that way that is desired, for, if the cushion be good there will be no shock transmitted beyond the frame of the engine. Somewhere between the tendency of a rotating body to rotate on its center of gravity, and the tendency to variations from that condition caused by constraints, resides the solution of the problem sought. As a step toward that solution I deem it necessary to eliminate entirely the idea that those parts having rectilinear, or reciprocating movements can be balanced by counterweights in the revolving parts of such rotating masses as flywheels and driving wheels.

The mind is not puzzled to apprehend correctly the operation of a body rotating in space, and can easily comprehend the fact that it will rotate upon its center of gravity. It is easy to understand also that, in an unsymmetrical rotating body, the point of greatest distance from the center of rotation is in the direction of the greatest deficiency of weight. The forces which produce the phenomena are mathematically tangible, and can be integrated in any practical or hypothetical case. When, however, a rotating body is constrained from rotating upon its center of gravity, by such a mass as the superstructure of a locomotive, the point of greatest prominence cannot be computed by any light as yet brought to bear upon the subject. The query then arises, why



Hall Automatic Block Signals on the Lehigh Valley Railroad.

NOTE.—*The two switches near Signal 4 connect with a siding between the two main tracks.*

load that portion which may already be too heavy? The point of greatest prominence in the rotating wheel will be found by turns to be at various points in the circumference, varying with variations of speed and constraint.

Some experiments made 10 years ago will throw some light on this subject. A disk 1 in. thick and 8 in. in diameter, fig. 1, with a segment *C* cut out of one side leaving a rim, was rolled upon a smooth floor at an initial velocity of about 600 turns a minute. On the side cut out a coat of paint was applied, so that a mark therefrom might be left on the floor. When the disk left the hand by which it was impelled, it seemed to roll smoothly for a distance of 5 or 6 ft.; after which it was seen to rise and skip along the floor, touching it at intervals of 2, 4 and 6 ft., leaving a mark of paint on the floor at every contact. It may with truth be said that there is nothing very surprising in this result; and that it is just what might have been expected. But, by the light which this simple experiment affords is it too much to suppose that the driving wheels of a locomotive, loaded as they frequently are, with a superabundance of balance weights, may at high velocities predominate over constraints and perform in a similar manner?

Let a wheel *W* be mounted upon a shaft *S*, which fits loosely in a box *B*, and let the wheel be heavier upon one side *H* than it is on the diametrically opposite side *L*., fig. 1. Let the box *B* be large enough to permit the wheel

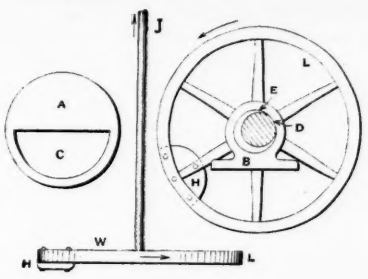


Fig. 1.

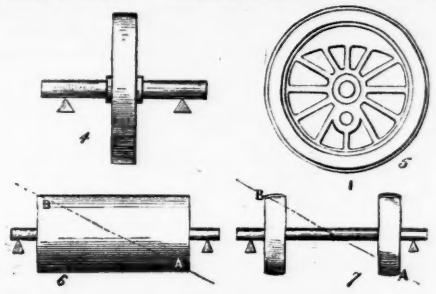


Fig. 2.

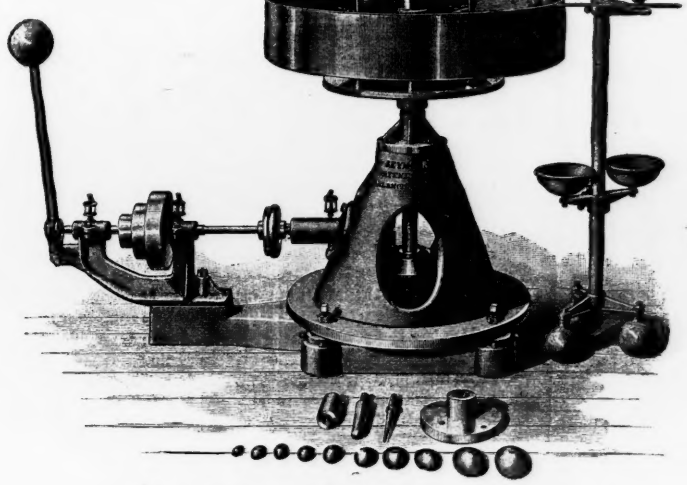


Fig. 4—Seymour's Rotary Balancing Machine.

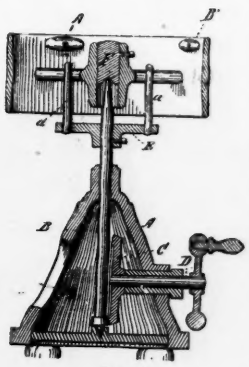


Fig. 3.

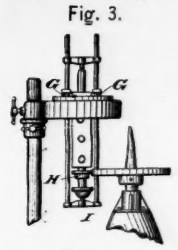


Fig. 5.

COUNTERBALANCING APPARATUS.

to rotate upon its center of gravity coincident with a contact *D* upon the light side of the hub. The retarding effect of friction will be such as to throw the contact forward, in the direction of rotation, to *E*, or in advance of the point of greatest deficiency of weight, and by using lubricants of varying viscosity, and varying the freedom of the shaft in the box, and the velocity, the point of greatest prominence may be made to appear anywhere on the periphery of the wheel. It was deemed incontrovertible that if the box were of infinite lightness, and was absolutely free to vibrate, and imposed no retarding influence by friction, the wheel would rotate upon its center of gravity and the point of greatest prominence would be at *L*. As in practice these latter conditions are unattainable, so the point of greatest prominence and the point of greatest deficiency of weight cannot be made to coincide. But they can be brought so nearly to each other that, in every instance where the velocity is sufficient, all doubt disappears, and points at which weights should be applied or excess of weight removed re ascertained to a certainty.

If the wheel just described be suspended by a flexible axis *J*, fig. 1, the weight *H* predominating over the other portions of the mass, and a rotary impulse is imparted through the means of suspension, the weight *H* will tend to move a straight line and draw the flexible axis with it. But as the rotary impulse is continued, the mass, consisting of the wheel and weight *H* will become established as a rotating body; and *H* will lose its identity as a revolving particle, and draw nearer to the position formerly occupied by the flexible axis. A flexible axis can be no more than a consequent of the phenomena of rotation and revolution. If it can be conceived that an axis of perfect flexibility support a rotating body, such axis can in no wise be considered a factor in the phenomenon of rotation. An axis becomes a factor in proportion to its inflexibility, or more properly in proportion to its rigidity, for every axis possesses some flexibility.

What, then, shall be the application of the above? It is to balance no parts by counterweights which cannot be considered components of the rotating mass. Under no circumstances must the mass be allowed to assume the character of a revolving body. These considerations lead us inevitably to definitions. I trust it has been noticed that I have endeavored to avoid confusing revolving bodies with rotating bodies. It is deemed necessary to conserve that distinction. The assumption that a piece of machinery was intended to be a rotating body does not make it so. The distinction is a natural one and should not be ignored.

There are stationary parts in the construction of nearly every machine which are capable of vibrating in unison with the times of rotation of some running, unbalanced part, and which are also capable of serving as accumulators of vibrations. Accumulation thus arising may be multiples of the times of the vibrations of other and heavier parts, and it is obvious that a violent shaking may ensue, even when the initial vibration is so small as to be almost inappreciable. Every mass of matter, simple or complex, great or small, has a natural isochronal capability of movement, the periods of which depend on inertia, distance from its natural center of motion and tendency to oscillate upon such center. When, in the combination of parts which constitute a machine, the periods of semi-rotation and the periods of natural vibration coincide, a continuous but not always uniform oscillation will be established. Upon the establishment of such oscillation the time of rotation will have become slower and the time of oscillation faster. When an unbalanced, rotating body runs at a sufficiently high velocity to assert its tendency to rotate upon its center of gravity it will strive to move, at each semi-rotation, in a direction opposite to the direction of vibration of the mass by which it is held in constraint, and if it were not for the time which necessarily elapses in the transmission of force from the rotating body to the vibrating mass the movements would be diametrically opposite. The conditions depending on dimensions, weights, times and structure are so varied and complex that the relative times of the movements can only be determined by experiment in each individual case. These "relative times of movements" often perplex the locomotive engineer, and lead him to think that the counterbalances in the wheels of his engine should be augmented in weight, when they are already too heavy. If the velocity of rotation were infinite the wheel would so far defy restraints as to strike the rail with its light side. And there is abundant reason for believing that, at the present high rates of running, the wheel frequently leaves the rail and strikes it again not many degrees in advance of the point of greatest deficiency of weight; indeed, something very like that is reported in one of the experiments by Professor Goss.

The velocity at which a body strives to rotate upon its center of gravity, in a rotating body the least under constraint, cannot be determined. And the constraints and impulses, by which "centrifugal whirling" of axes is rendered possible, bring into existence forces which defy computation. Any effort, therefore, to balance the rotating parts of a complex machine from indications afforded by vibrations, or directions of motions of individual parts, will ever remain futile.

There is room for suspicion that the conditions under which the Purdue University locomotive was running were misleading. The only analogy that exists between a wheel running on a friction roller like those of the university engine, and a wheel rolling on a rail, is that, in one sense, they both are rotating bodies. In all other respects they are extremely dissimilar. Every point in the periphery of the wheel resting on the *roller* describes a circle; while such point in the wheel on the rail describes a cycloid. The former cannot sustain itself in a vertical position against gravity, excepting by virtue of that property which holds rotating bodies in their original planes of rotation; but the latter can sustain itself by the additional force which arises from the constraint of its inherent, central forces. It is owing to these central forces that a hoop or wheel stands erect while rolling upon the ground. The centrifugal force being free to exert itself in one direction only—upward—the point of contact on the ground being the center of motion, and being constrained by the ground from adjusting itself to a rotation in space upon its center of gravity, the other factors, namely, the earth's attraction, and centrifugal force, are left to phenomenally govern it. It is obvious that the locomotive poised upon friction rollers at the Purdue University is very far from being physically the same object that it would be if running on a railroad. I will leave the definitions of the diverse characters of these two objects to the mathematical physicist.

The locomotive at the Purdue University calls to mind the Fontaine locomotive which was illustrated in the *Railroad Gazette* in November, 1881. In a conversation with Mr. Fontaine five or six years ago he told me that he had discovered the problem of balancing his engine to be very much different from that of the ordinary locomotive, and, he thought, very much simpler. It is to be regretted that he abandoned it before he had developed the good qualities incidental to its easy susceptibility to balancing and consequent smoothness and stability of running. The upper wheels in the Fontaine engine were just as exclusively rotating bodies as those at the university, resting on friction rollers. There is no similarity otherwise, however, within the meaning of this paper.

As incidental to the subject of the balancing o wheels, let us consider the effect of a train of wheels such as of cars and locomotive, under considerable speed. Consider the vast weight of these rotating and revolving parts of a train. They cannot obey all the requirements of the law which governs rotating bodies, because of the constraint imposed by the rail, which forces the wheels out of their natural trajectory. Like the wheel and hoop instanced above, constrained by the rail from obeying one of the central forces, they exert an energy downward, proportional to such constraint, and hence the well-recognized depression produced by rapid transit over bridges. All such depression beyond what is due to weight is dynamical, not statical, and is owing to the rapidly revolving wheels: their weight greatly augmenting their dynamical effect.

It is desired to be understood that this paper deals only with those bodies which, by reason of high velocities, predominate sufficiently over restraint to enable them to rotate upon their centers of gravity. The balancing of rotating bodies can be obtained by no other means than by running up to such velocities. A study of the methods employed in balancing the rotating parts of machinery will throw some light upon this question; and probably the methods employed and experiments conducted by the author in this work at the Defiance Machine Works will best answer the purpose. The apparatus employed is the result of 15 years' experience and has been selected, without solicitation from the manufacturers, by the Franklin Institute, and Cornell and Michigan universities, for laboratory experimentation.

Thin disks or wheels like 4, fig. 2, may be approximately balanced by the straightedge test, but it is a tantalizing approximation and impracticable with high speeds; while in treating objects like 6, figs. 2, the straightedges are not only useless, but are likely to give wrong results. No man would attempt to balance two pulleys at once, as represented by 7, fig. 2, from fear of getting an excess of weight in such relative positions as are shown by *B* and *A*. Yet there are mechanics who try to balance drums as represented by 6 and 7, fig. 2, and comfort themselves with the assumption that they have done the best they can.

Fig. 3 represents a small experimental model. *A* is the case of the machine; *B*, steel spindle; *C*, frictional gear; *F*, plug in the hole of pulley; *A'* and *B'*, balance weights in rim of pulley in process of balancing. Fig. 4 represents a larger machine suitable for balancing objects from one to a thousand pounds. It is driven by frictional gearing, frictional clutch, double counters and tight and loose pulleys; so that when the object to be balanced has attained the desired speed, the disturbing influences of the motive power may be withdrawn.

In describing the method of balancing the reader is left to infer the reasons for the operations, under the belief that they are sufficiently obvious. The object to be balanced is placed on the pivot of the spindle *B*, as shown in figs. 3 and 4, and before rotating, a weight is located near the center of the rim, of sufficient size to produce a standing balance. The pulley is then rotated and marked upon the edge of the rim with chalk. If the mark occur within one-fourth of the circumference of the pulley from the weight, the weight is raised; if the mark occur at more than than one fourth of the circumference of the pulley from the weight the weight is depressed. If by these steps the edge of the rim be reached and the pully still "runs out," the weight must be increased and a counter-weight placed diametrically and transversely opposite, so that the relative positions of the two weights will be as those of *B* and *A*, in 6 and 7 fig. 2. Care must be taken at every adjustment of weights that a standing balance be maintained. If, upon the readjustment of the first weight, the mark occurs at one-fourth of the circumference of the pulley from the weight, nothing more can be done with such weight, but an additional weight must be placed at the mark, and if this second weight disturb the standing balance, locate a counter-weight, as first described.

When the mark does not occur immediately above the weight, or directly opposite, two weights may be substituted for the one, placed so that they revolve in different paths and in the circumference of the pulley, to secure a standing balance. Then manipulate one or both of the weights according to their influence on the pulley, as implied by the first plan of operation. Theoretically, no more than two weights are required; but pulley-arms or other objects sometimes make it necessary to divide the weights.

In balancing objects in which the center of magnitude is inaccessible, such as, for instance, a planer-cylinder or threshing machine cylinder, an entirely different method is employed. A planer-cylinder is suspended in gimbals, as shown in fig. 5, and driven by frictional contact. The frictional gear, *H*, is brought in contact with the face-plate by a steady bearing of the hand on the crosshead, *I*, until a sufficient speed of the cylinder is attained to throw its maximum amount; then it is borne away from the face-plate, and marked with chalk upon the journal or other concentric part. The mark will always be found on the light side. The correction should be made at or near the end of the cylinder, either by cutting away the opposite side or by counter-weighting the light side.

This general system of balancing is applicable to car wheels, and fig. 6 represents a car wheel furnished with holes, *a a*, and so constructed that weights may be added to it near the periphery, in lines transversely to the plane of rotation. If there is an excess of weight at *b c*, weights should be secured at *d e*, in order to prevent the violent lateral play to which wheels running at a high rate of speed are liable. The positions which these weights should occupy can only be ascertained by rotating the wheel to be balanced upon a pivot at a sufficiently high speed to cause the wheel to rotate in a plane parallel to its greatest sectional weight. While so running, the wheel can be marked by chalk, the marked portions indicating the points of greatest deficiency of weight.

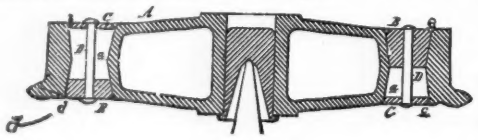


Fig. 6.

LAWS.

From these and other extended and costly experiments, conclusions have been reached which seem sufficently stable to be regarded as laws. For convenience of reference and for conciseness the following arrangement has been adopted:

1. For a rotating body to run smoothly, without jarring its surroundings, its properties must be the same as those of a body rotating in space, having a mechanical center around which it is desired it should rotate, and a mechanical plane in which it is desired it should continue.

2. Its mechanical center must coincide with its center of gravity, or it will leave its mechanical center upon which it is supposed to have been set in rotation, and assume a center nearer to the superabundant weight by which its equilibrium is destroyed.

3. Every rotating body must be considered as having an axial dimension or line, measurable in a direction transverse to its plane of rotation. In order that it may rotate in a certain mechanical plane, relatively to its form, there must be an equal distribution of the product of weight multiplied by velocity in directions parallel to the plane of rotation, about every point in its axial line.

4. If a rotating body have a corresponding distribution of the product of matter multiplied by velocity about all points in a circle described by its center of gyration, it will be in equilibrium when at rest (if not rotating) upon its mechanical center. In other words, its mechanical center will coincide with its center of gravity. The center of percussion of a rotating body is that point at which it can oppose resistance, or strike an obstacle without communicating a shock to its axis. It coincides with its center of gyration.

5. If there be within all parts of a circle described by the center of gyration of an unbalanced, rotating body a sufficient amount of matter to resist by reaction the centrifugal tendency of an excessively heavy portion, such heavy portion will strive to recede from the mechanical center so long as the impelling force, applied at the mechanical center, continues and is opposed by inertia; but when the inertia is overcome, the heavy portion will strive to approach the mechanical center.

6. If the axial diameter of a rotating body exceed its equatorial diameter, and its plane of rotation be disturbed, it cannot recover its equilibrium within the first plane, but will strive to rotate in a new plane, parallel to its greatest sectional weight.

7. In an unconstrained, rotating body the point of greatest prominence, or point of greatest distance from the center of rotation is also the point of greatest deficiency of weight.

If some of the above maxims seem too obvious to be entitled to so formal a position as they are given it is owing to a desire to comprehend all the conditions and qualities of the rotating bodies with which mechanics have to deal. Mechanics, and even teachers of the laws of physics, frequently drift into conclusions and entertain impressions which indicate an entire absence of observation. They are very persistent in holding to these impressions. A scientific journal, in treating of wheels on shafts, states that "an unbalanced rotating disk will tend to bend or spring the shaft toward the heavy side." And again, swelling with the inspirations of mathematical formulæ, "an overweight of *w* pounds, describing a radius, *r*, with a velocity of *v* feet per second, will bring a strain upon the shaft *in the direction of overweight, etc.*" This erroneous notion prevails among mechanics. By experiment it is learned that in an unbalanced rotating body the point of greatest prominence is the point of greatest deficiency of weight. The journals of shafts carrying unbalanced wheels or weights will wear most on their light sides, and not, as is too often supposed, on their heavy sides. All mechanics easily comprehend the fact that unconstrained rotating bodies rotate upon their centers of gravity, but too many of them lose sight of it in practice.

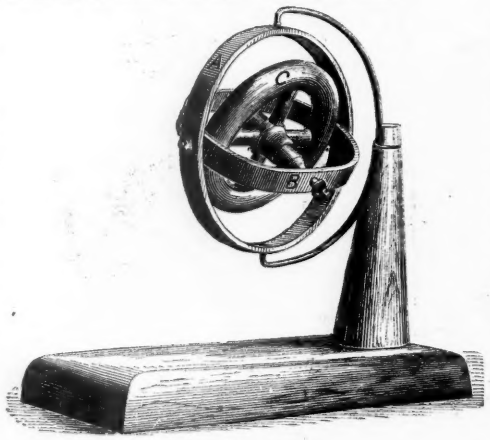


Fig. 7.

Millwrights and millers often lose their reckoning in balancing millstones, and in their perplexity leave a stone that runs in a plane parallel to its face, ignoring the fact that it is not in standing balance. Such an adjustment of balance weights as is described in the rules for balancing would overcome all difficulties and insure a true wearing of the parts by which a millstone is poised.

It has been demonstrated in a combination of three rotating bodies, having individually and collectively a common center of gravity, like, for instance, a ring, *B*, fig. 7, pivoted within a ring, *A*, and a wheel, *C*, pivoted upon its axis within the central ring, and the axis of each member or rotating body normal to the axis of its contiguous fellow-member, that the outer and inner members will strive to maintain planes of rotation parallel to each other and in the same direction. If, however, the outer member be subjected to an oscillatory motion upon its axis, the inner member continuing to rotate, the intermediate member will be set in motion upon its axis, either in oscillation or complete rotation; for the inner member will strive at each movement of the outer member to establish itself in corresponding plane (as to parallelism) and direction of rotation. In thus striving it will set the intermediate member in rotation, and if the times of oscillation of the outer member be suitable the intermediate member will assume a complete rotation. All these conditions are realized in Bohnenberger's apparatus, and account for its phenomena.

Rotating bodies can be so poised that they do not oppose resistance to change of plane of rotation. A body may, without resistance, and in perfect equilibrium, rotate upon two axes, provided each axis be situated in the other's plane of rotation, and both rotations be around a common center of gravity. It is, therefore, erroneous to state, as is often done, that all rotating bodies oppose resistance to change of plane of rotation. The earth presents an example of rotation upon two axes by the oscillations of its plane of rotation, which cause the precession of the equinoxes. If those oscillations could be changed into complete rotations, all parts of the earth would be exposed in turn to the direct rays of the sun. The oscillations in the plane of rotation of a boy's spinning top are in point.

There is a class of portable farm engines with a traction apparatus by which they are transported upon common roads. When an engine of that class is in transit, its balance wheel is in rapid rotation; and the the persistency with which the wheel resists sudden changes of plane of rotation, is noticeable as an agency by which the engine is preserved from severe jolts upon a rough road.

Acceleration of the rotations of a body may be produced by subjecting its supports to uniform vibrations. The first condition in order to produce such acceleration of rotation is that there must exist a certain relation between the times of rotation and the times of vibration. The second condition is that the center of gravity of the rotating body must not coincide with its mechanical center; in other words, the rotating body must be "out of balance."

Solution: The rotating body, in striving to assume rotations upon its center of gravity, will impart a vibratory motion to its supports. Then, when the extraneous vibratory motions are applied, and occur counter to the inherent vibrations, the resultant force is such as to push that portion of the rotating body having an excess of weight out of its course; and it must, during the succeeding semi-revolution, fall back toward the center of gravity. In thus falling it acquires additional velocity. The initial impulses of the extraneous vibrations are quite as likely to retard the rotations as to accelerate them; but if one extraneous impulse occurs exactly counter to an inherent vibration, and the latter slightly preponderate in force, there will ensue an acceleration of speed, and the succeeding inherent vibrations will just sufficiently lead the extraneous vibrations to insure a constantly accelerating rotation.

The above solution is applicable to all rotating bodies which are liable, by being out of balance, to vibratory influences.

With regard to balancing the reciprocating parts of steam engines, it has been urged that steam engines never run at so high a speed as to insure in their rotating parts a rotation upon their centers of gravity. In answer it may be said that then there is no certainty as to what portions of such rotating parts throw so as to be points of greatest prominence. It has been shown that varying degrees of constraint, speed, weight, etc., cause such wide variations in positions of points of greatest prominence that the latter cannot be taken as indications of positions of points of greatest deficiency of weight, unless the velocity of rotation be sufficient to dominate their adjuncts. It may be urged that this writing does not sufficiently show the way by which the reciprocating parts of an engine may be balanced. Granted. But it has shown some of the ways in which it can *not* be done. And there must be very much more of such preliminary work done, for nothing less can conduce to a thorough comprehension of the principles involved. Nearly all that has been done in attempts at balancing the reciprocating parts of steam engines by counterbalances in cranks and wheels, has led to a labyrinth of absurdities. The minds of such as have been in the quest have overlooked the effects of counterbalances in directions perpendicular to the line of travel of reciprocating parts.

State Railroad Commissioners' Reports.

NORTH CAROLINA.

The Railroad Commissioners of North Carolina, R. W. Wilson, T. W. Mason and E.C. Beddingfield, have issued their third annual report. The length of railroads in the state is now 3,577 miles, which apparently includes some lumber railroads. The length of new road built during the last two years is 165 miles. The report is very brief, occupying only four pages of the volume in which it is issued. It is devoted chiefly to the matter of assessments and taxation. The total assessment of the railroads of the state for the year 1893 is $24,228,955, which is twice the amount assessed in 1890. This large increase is due to an arrangement which the state has made with many important roads in the state by which they surrender the right, which they have enjoyed ever since they were organized, of exemption from taxation.

The Commissioners have heard 92 complaints since their last report, and they say that the railroads have promptly corrected matters complained of. The 583 pages of the book are mostly taken up with the reports of the individual roads, copies of laws of the Commission, freight classifications, etc. The Commission prescribes annual rates for telephone exchange service. The rate for business-houses is $64 a year, and for residences $44.

OHIO.

Advance sheets have been issued of the twenty-sixth annual report of the Railroad Commissioner of Ohio. A few statistics are given. The length of railroad in the state is stated in one place as 8,643 miles; in another place it appears to be 8,423. Some of the other statistics are equally doubtful, the number of persons killed on railroads being stated in one place as 493 and in another as 532. In June last an inspector was appointed, Mr. James McMillan, of Toledo, and he has inspected 24

of the 54 railroads in the state. His detailed reports, showing physical condition, etc., are on file in the Commissioner's office, but it does not appear that any part of these reports is to be published. Twenty-four new interlocking plants have been approved during the year and 52 highway grade crossing complaints have been heard, of which 30 were dismissed; in the other 22 cases the railroads provided watchmen or bells. The railroads of the state are equipping their cars with air-brakes and automatic couplers "as fast as time and means will permit." The principal roads are putting in apparatus for lighting passenger cars with gas and heating them from the locomotive; how fast, is not stated. Block signaling is receiving marked attention, and "there is a notable improvement during the past year."

Chicago Traffic Matters.

Freight Traffic.—Favorable weather the past week stimulated business in nearly all directions. The inbound grain traffic was much larger than anticipated, the aggregate deliveries by the 11 leading lines being 4.800,000 bushels against 2,438,000 bushels the week ending February 10 last year, and 2,122,000 bushels in 1892. Last year, however, business was interrupted by severe weather over a wide area. The most encouraging feature in the past week's business was the outward shipments. The gain in merchandise, iron and other traffic was marked. The Southern and Southwestern roads were the largest benificiaries, but the more northern lines secured a good increase. As the spring trade is virtually open and leading industries show increasing evidences of a healthy revival, railroad managers feel hopeful. The eastward grain traffic of the Atchison, Topeka & Santa Fe was reported better than at any corresponding time in four years. There has been a large increase in the shipment of merchandise and machinery to Texas points to which until recently Chicago roads have carried very little freight.

The deliveries of flour at Chicago by the leading Western railroads for the week ending Feb. 10, and the same time the two preceding years, compare as follows (barrels):

	1891.	1893.	1892.
C. & N. W	14,382	16,389	32,049
Ill. Cent.	150	1,050	.....
C., R. I. & P.	2,550	3,040	2,775
C., B. & Q.	2,257	10,944	24,841
C. & Alton	1,500	2,700	2,575
C. & E. Ill.	450	150	.....
C., M. & St. P.	12,150	32,900	24,450
Wabash	300	1,200	1,365
C. & G. W.	9,196	9,467	14,109
A., T. & S. Fe	.....	900	925
L., N. A. & C.	.....	.....	.....
Total	42,935	78,760	101,780

The number of cars of grain received at Chicago by the leading Western railroads for the month of January, and for the corresponding time the two preceding years, compares as follows:

	1891.	1893.	1892.
C., B. & Quincy	3,034	2,574	2,579
C., R. I. & P.	1,803	1,433	1,733
C. & Alton	936	1,108	427
Ill. Cent.	2,674	2,127	1,662
C. & N. W.	2,973	2,914	3,260
Wabash	661	657	393
C. & E. Ill.	397	911	358
C., M. & St. P.	2,677	3,305	2,264
Wis. Cent.	14	26	23
A., T. & St. Fe	866	1,772	643
C. & G. W.	436	1,179	465
Through and special	982	3,082	2,415
Total	17,453	21,138	16,922

The following shows the deliveries of grain (bushels) at Chicago by the leading Western railroads for the week ending Feb. 10 and the same time the two preceding years:

	1894.	1893.	1892.
C. & N. W.	822,000	472,000	417,000
Ill. Cent.	527,000	405,000	189,000
C., R. I. & P.	486,000	202,000	395,000
C., B. & Q.	1,574,000	529,000	325,000
C. & Alton	196,000	117,000	41,000
C. & E. Ill.	88,000	122,000	77,000
C., M. & St. P.	742,000	213,000	388,000
Wabash	133,000	102,000	125,000
C. & G. W.	105,000	128,000	81,000
A., T. & S. Fe	210,000	118,000	89,000
L., N. A. & C.	7,000	.....	.....
Totals	4,890,000	2,433,000	2,122,000

Passenger Traffic.—Nearly all the roads reported a fair increase over the preceding week. A large number of merchants were attracted here by a large auction sale of dry goods. The Southern and Southwestern lines also reported a considerable increase in travel to winter resorts in the South Atlantic and Gulf States. Pacific coast travel was also better, but the hard times more than offsets the attractions offered by the Mid-Winter Fair at San Francisco. Travel in the extreme Northwest shows very little increase, and the strictly north Pacific coast roads complain that business is very light.

Duplex Water Gages.

We illustrate herewith a simple and ingenious device for securing two water gages for a boiler with but two holes tapped into the boiler. It consists simply of two bulbs which screw into as many holes in the boiler, and each bulb has a partition running through it which divides it into two parts. The usual water glass is attached to each divided part of the bulb. This bulb is shown in fig. 1 with the two holes to which water gages are attached. Fig. 2 shows the bulbs with the water glasses attached. Enginemen will understand the utility of this device. It answers every purpose of two separate water gages and will show a difference of level the same as two water glasses would when one becomes clogged.

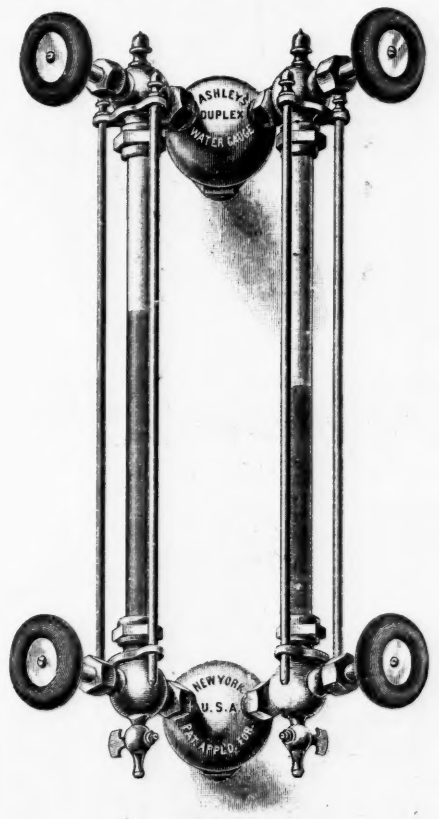
An additional feature of these water gages is shown

Fig 1.

The Ashley Duplex Water Gage Bulb.

in fig. 1, which consists of a little choke valve to prevent the escape of steam and water and consequent scalding when a glass is broken. This is shown in the left-hand lower cock. The valve is forced back by a little stem when it is required to open it, and the two, one at the top and one at the bottom of the tube, being forced back until the steam pressure is equalized, there is no tendency for them to move out and stop the passageway; but if the glass is broken they are both immediately forced out by the pressure of the steam and water and stop up the passage, thereby preventing the escape of steam and water.

This little valve is cut with oblique spiral-like wings, which give to the valve a rotary motion when



Duplex Water Gage.

the steam escapes. If the valve is choked by sediment it is self-cleaning, for by opening the pet cock of the water gage and screwing the stem against the valve it forces it back, gives it a bearing on the stem, and allows the steam or water to escape. The escaping steam gives it a rotary motion, and like a drill it bores its way to the valve seat, removing any sediment or clay that may have become deposited there and effectually clearing the passage. These gages are made in three styles, with ⅛ in. and ¼ in. boiler connections. They may be immediately adjusted, of course, to the holes already in the boilers. These ingenious attachments for boilers are manufactured and sold by Frank M. Ashley, of New York City.

Railroad Traveling in South Carolina in 1836.

Harriet Martineau's famous book on "Society in America" is now rarely seen, so that the following account which it gives of a journey from Columbia to Charleston, in 1836, over the South Carolina Railroad, will be new to most of the present generation of readers:

That which may be seen on either hand of the Charleston & Augusta Railroad is scarcely less beautiful [than the views between New Orleans and Lake Pontchartrain]; but my journeys on it were by far the most fatiguing of any I underwent in the country. The motion and the noise are distracting. Whether this is owing to its being built on piles in many places; whether the fault is in the ground or the construction, I do not know. Almost all the railroad traveling in America is very fatiguing and noisy. I was told that this was chiefly owing to the roads being put to use as soon as finished, instead of the work being left to settle for some months. How far this is true, I do not pretend to say. The railroads which I saw in progress were laid on wood instead of stone. The patentee discovered that wood settles after frost more evenly than stone. The original cost, in the State of New York, is about $2,000 per mile.

One great inconvenience of the American railroads is that, from wood being used for fuel, there is an incessant shower of large sparks, destructive to dress and comfort, unless all the windows are shut, which is impossible in warm weather. Some serious accidents from fire have happened in this way; and during my last trip on the Columbia & Philadelphia Railroad, a lady in the car had a shawl burned to destruction on her shoulders; and I found that my own gown had 13 holes in it, and my veil, with which I saved my eyes, more than could be counted.

My first trip on the Charleston railroad was more amusing than prosperous. The arrangements were scarcely completed, and the apparatus was then in a raw state. Our party left Columbia at seven in the evening of the 9th of March, hoping to meet the railroad train at Branchville, 60 miles from Columbia at 11 the next morning, and to reach Charleston, 62 more, to dinner. Towards morning when the moon had set, the stage bumped against something, and the driver declared he must wait for the day-spring before he could proceed another step. When the dawn brightened we found that we had, as we supposed, missed our passage by the train, for the sake of a stump about two inches above the ground. We hastened to breakfast at Orangeburg, and when we got to Branchville, found we need have been in no hurry. The train had not arrived, and, some little accident having happened, we waited for it till near two o'clock.

* * * * * * * * *

For the first 35 miles, which we accomplished by half-past four, we called it the most interesting railroad we had ever been on. The whole 62 miles was almost a dead level, the descent being only two feet. Where pools, creeks and gullies had to be passed, the road was elevated on piles, and thence the look down on an expanse of evergreens was beautiful.

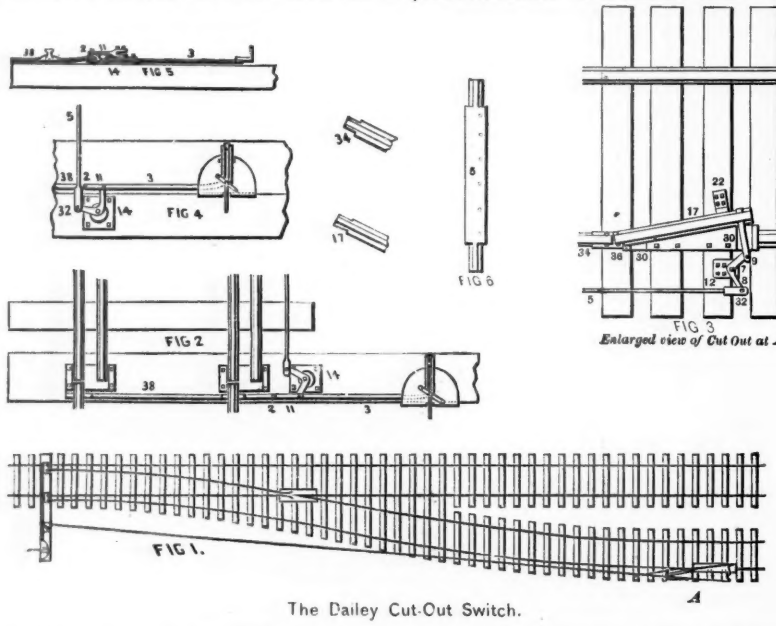
At half-past four, our boiler sprang a leak, and there was an end of our prosperity. In two hours, we hungry passengers were consoled with the news that it was mended But the same thing happened again and again, and always in the middle of a swamp, where we could do nothing but sit still. The gentlemen tried to amuse themselves with frog hunting; but it was a poor resource. Once we stopped before a comfortable looking house, where a hot supper was actually on the table; but we were not allowed to stop, even so long as to get out. The gentlemen made a rush into the house to see what they could get. One carried off a chicken entire for his party; another seized part of a turkey. Our gentlemen were not alert enough. The old lady's table was cleared too quickly for them, and quite to her own consternation. All that we, a party of five, had to support us, was some strips of ham, pieces of dry bread and three sweet potatoes, all jumbled together in a handkerchief. Our thoughts wandered back to this supper table an hour after, when we were again sticking in the middle of a swamp. I had fallen asleep (for it was now the middle of a second night of traveling), and was awakened by such a din as I had never heard. I could not recollect where I was. I looked out of the window, and saw, by the light of the moon, white houses on the bank of the swamp, and the waving shrubs of the forest; but the distracting din was like nothing earthly. It presently struck me that we were being treated with a frog-concert. It is worth hearing, for once, anything so unparalleled as the knocking, ticking, creaking and rattling, in every variety of key. The swamp was as thick of noises as the forest is of leaves; but, five minutes of the concert are enough, while a hundred years are not enough of the forest. After many times stopping and proceeding, we arrived at Charleston between four and five in the morning; and, it being too early to disturb our friends, crept cold and weary to bed at the Planters' Hotel. It was well that all this happened in the month of March. Three months later, such detention in the swamps by night might have been the death of three-fourths of the passengers. I have not heard of any mismanagement since the concern has been put fairly in operation.

Raising Track on the Illinois Central.

The Illinois Central Railroad Company has commenced the work of raising its low track along the Mississippi River north of New Orleans to such an elevation as will get it above water level in case of a crevasse. This will include the greater part of the line from Ponchatoula northward to Fallou, a distance of about 40 miles. The track along this section will be raised from 2 to 3½ ft. The bridges and trestles at a number of places are already at the required height. The work will be so carried on as to offer the least possible obstruction or delay to regular traffic, the track being raised but about six inches at a time. The earth used will be taken mainly from Ponchatoula, where a better quality can be obtained than along the line of the road. The ballast will be taken from the gravel beds near McComb City, about 20 miles north of Fallon. The work will be under the supervision of Mr. A. Philbrick, Division Roadmaster, with two assistants from the office of Chief Engineer Wallace. It is expected that the work will be completed by the first of May.

The Dailey Automatic Cut-Out Switch.

A cut-out switch, for preventing cars on a siding being blown or carelessly sent upon the main track was designed by Mr. Dailey, Superintendent of Track of the Michigan Central about seven years ago, and at that time put in use on his road and also shown and described in these pages. The accompanying drawing shows it as now made by the Sheffield Car Company, at Three Rivers, Mich., and largely and increasingly used by many roads. The legislatures of several states now require, by statute, the use of an equivalent device, and it may partly be due to this that, as we are informed, the orders for it during the past season were largely increased.



The Dailey Cut-Out Switch.

The device is well shown in the drawing, the motion being transmitted from main switch to the "cut-out" by means of bell cranks and a line of 1¼ in. gas pipe carried on suitable sheaves. The ends of the fixed rails are carried by a heavy iron plate, which receives their respective bases, these being properly shouldered by the section men before the plate is put in place. The base plate serves a double purpose—in the first place forming a rigid support for the "cut-out" rail in whichever position it may be; and secondly, firmly holding the connecting rails in place, preventing any interference with the proper working of the "cut-out" by creeping, whether from expansion or any other cause. It will be seen that the side track is automatically broken, except at such times as the main switch is set for the siding, thus rendering it practically impossible for side tracked cars to get in the way of the main line.

Kelly's Packing for Air-Brake Pistons and Rods.

Nearly everything has been tried and used for packing air-brake pistons and rods, and we illustrate herewith an ingenious device patented by C.J. Kelly, of the Vandalia shops at Terre Haute, Ind. The device consists of an attachment to the piston or rod of an air-brake cylinder

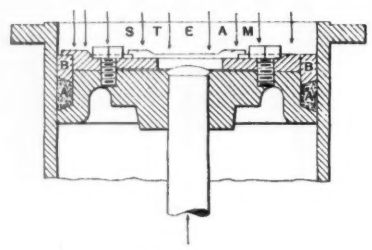


Fig. 1.

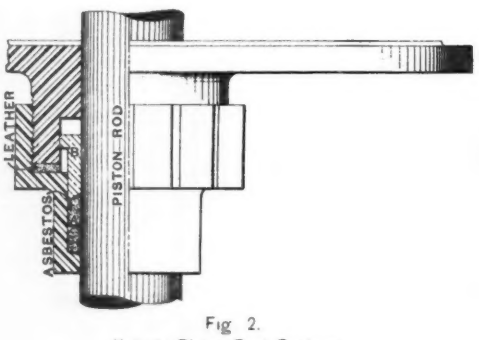


Fig. 2.

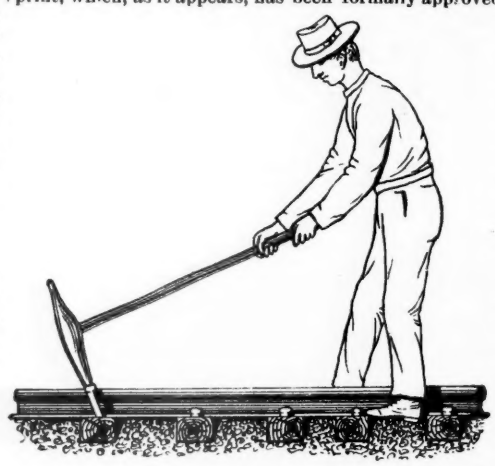
Kelly's Piston-Rod Packing.

shown in figs. 1 and 2. Fig. 1 is a section of a piston and rod of a push-down locomotive brake cylinder; and the packing device is shown in the wedged shape collar at *B*, which surrounds the piston and is crowded in against the asbestos packing *A*, so as to crowd it out tightly against the cylinder. The greater the air pressure the closer the collar is wedged in under the asbestos and the tighter the joint is made. Fig. 2 shows the packing of a piston rod for a pull-up driver-brake. It works upon the same principle.

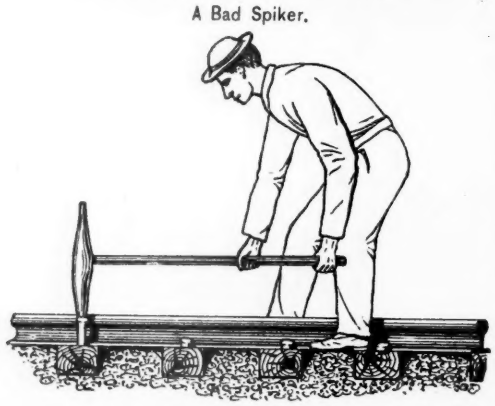
This packing ring has been in use for a year and has given excellent results on 75 locomotives of the Vandalia road and is on trial on several other roads, giving the best results. It is claimed that it effects a saving of 90 per cent. over the old style of packing; that there is no danger of burning out or that it will get hard, and that it effects a tight joint. The manufacturers claim many advantages for this packing, among others that it can be added without any alterations, that a piston rod can be packed in five minutes, that 10 cents' worth of asbestos will repack an engine for two years, and that it increases the efficiency of the air-brakes.

A Good and a Bad Spiker.

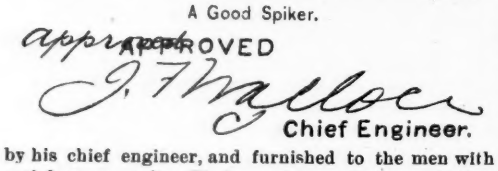
The Illinois Central road has a supervisor of track, whose name is not furnished to us, who has a habit of effectively illustrating his instructions to his section foremen. The drawing herewith is copied from a blueprint, which, as it appears, has been formally approved by his chief engineer, and furnished to the men with satisfactory results. The lesson is so well expressed that words can add nothing to it. It will be observed that the "good spiker" has an air benignant and urbane, while the countenance of the "bad spiker" expresses malignity. This is plainly the reflex result of habits and obedience to instructions.



A Bad Spiker.



A Good Spiker.



Analysis of Boiler Tests by Bryan Donkin and Kennedy.

The following translation of an analysis of boiler tests and results is from the *Portefeuille Economique des Machines*. In general, boiler tests will not bear close comparison, because they are neither made by the same persons, in the same manner, nor with the same fuel. But considerable importance may be attached to tests made in England during the past two years by Messrs. Bryan Donkin and Kennedy upon a number of types of boilers including the forms in most general use in European practice. The tests were all made in exactly the same manner and give data, very useful for comparison. Nine types of boilers were tested as follows: 1. Vertical tubular with natural draft. 2. Lancashire with Galloway tubes. 3. Locomotive, special type. 4. Water-tube, Naeyer's. 5. Cornish. 6. Lancashire. 7. Traction engine, portable type. 8. French or elephant boiler. 9. Locomotive, regular type. All were internally fired excepting 4, Naeyer's water-tube boiler, and 8, the French, or elephant boiler, both of which had the firebox outside of the boiler.

Every precaution was taken to obtain exact data and make all tests comparable. Boilers operated with feed-water heaters, arranged to utilize heat from gaseous products of combustion otherwise lost, were tested with and without their assistance. The tests were continued from six to twelve hours, according to circumstances. The fuel used was that known as "Nison's Navigation," one of the purest and most uniform of English coals, and the same was used for all tests. The evaporation is, in all cases, finally reduced to the equivalent evaporation from and at 100° C. The dryness of the steam and amount of entrained water were unfortunately not determined, making the tests less complete than they otherwise would have been. All boilers tested were in good order, both as to cleanliness and repair, and all flues, chambers, hot-air and smoke ducts thoroughly cleaned. Before each test was begun the boiler setting or jacket was allowed to attain a proper temperature. Samples of coal used, after being thoroughly dried, were analyzed by Messrs. Thomson and Atkinson, with the following result: Carbon, 88.77 per cent. hydrogen, 4.12 per cent.; oxygen, 2 38 per cent.; nitrogen, 0.98 per cent.; sulphur, 0.68 per cent.; ash, 3 07 per cent.; water, 0.00 per cent., making 100 per cent.; or, in other terms, volatile substances, 11.72 per cent.; fixed carbon, 84.05 per cent.; ash, 3.21 per cent.; water, 1.12 per cent.; 100 per cent. in all.

The water evaporated per pound of fuel is reduced to that obtainable per unit of weight of the fuel employed, if pure and dry. These figures are more relative than absolute, but aid in arriving at conditions of uniformity necessary to obtain exact comparison between the performance of different boilers tested. The calorific power of the fuel was determined independently by Mr. Scheurer Kesterer. It amounted to 15,640 heat units. Determined from the chemical analysis already given it is 15,560, which is the value taken throughout the tests; and gives 16.1 lbs. of water per pound fuel from and at 212 deg. Steam was used continuously until test was completed with all excepting locomotive boilers. The fire was drawn both at the beginning and end of test in order to insure greater accuracy. By working rapidly no steam pressure was lost by drawing and replacing the fire. The half burned coals as they fell into the ash-pit were replaced on the grate, all under the grate at the end of test being carefully weighed. At completion of test all cinders were withdrawn and divided into three classes, as follows: 1st. Slag or fusible and incombustible material in large enough pieces to be handled. 2d. Ashes which pass through a screen of .47-in. mesh. 3d. Coal not burned, which is deducted from the weight of fuel consumed. Samples of the gaseous products of combustion were taken, the absorption of carbonic acid being to reduce to a minimum by immersing the vessel used for obtaining samples in a solution of salt water. The feedwater was carefully measured in gaged tanks and the weight taken as a check. The temperature of the gases were taken by an air pyrometer.

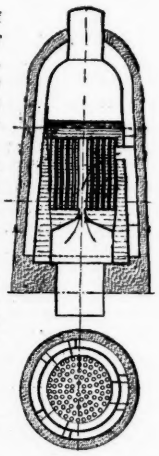


Fig 1.

The record of the steam pressure was taken by a self-registering monometer, which was frequently compared with the steam gage. The coal used was previously placed in sacks weighing over 100 lbs. each. With most of the boilers tested, the following method of determining the loss due to radiation from the boiler, jackets and settings was employed: The grate surface was greatly reduced by firebrick being laid thereon while the damper was adjusted to just maintain enough draft to keep the fire well ignited. When the proper boiler pressure has been attained, the fire was drawn and the test of loss by radiation begun by immediately renewing the fire with sacked coal previously weighed. The supply of fuel and the dampers were then regulated so as to keep the boiler pressure constant, with feed-water shut off, and all escape of steam prevented, the water level in the boiler, of course, remaining constant. This test was continued six or eight hours, after which the fire was drawn and the weight of unburned coal de-

ducted from the total weight charged. From the amount of coal so consumed the loss by radiation was determined.

The temperature of the gases of combustion were taken at short intervals, while precautions were taken

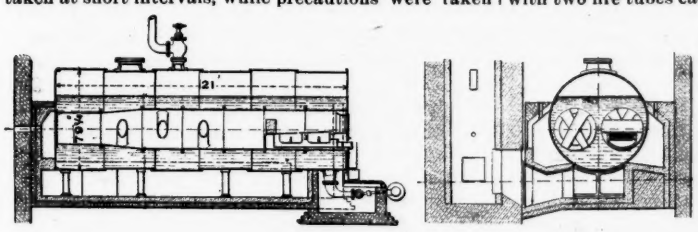


Fig. 2.

to allow no cold air to enter the flues or combustion chambers through any openings which might be in them. The temperature of the atmosphere was also noted frequently.

The experimenters acknowledged the impossibility of obtaining accurate results, but nevertheless considered it as exact as could have been adopted under the circumstances. The amount of moisture in the fuel was determined by weighing a sample of the coal used each day before and after desiccation. In each test the heat expended was determined under the following headings, whose sum should equal the total heat produced by combustion:

1. Evaporation of water from and at 212 deg. 2. Loss with gases of combustion. 3. Evaporation of moisture

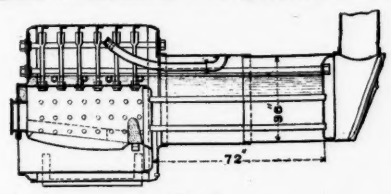


Fig. 3

in the fuel. 4. Radiation. 5. Loss by incomplete combustion. 6. Loss by drawing the fire. 7. The remainder due to errors and omissions. The division is made in hundredths; in certain cases the sum of these parts exceeds 100, the excess being caused by entrained water.

First Test.—The first test was of an old, small, vertical boiler, used as a reserve in the shops of Messrs. Bryan & Donkin. This boiler has an internal firebox and small grate surface. It will be seen by table, column I., that the proportion of carbonic oxide is higher in this than in any of the other boilers tested. This is on account of the air supplied to the firebox being deficient in quantity. It was taken through a tube 10 in. in diameter, containing an anemometer designed to

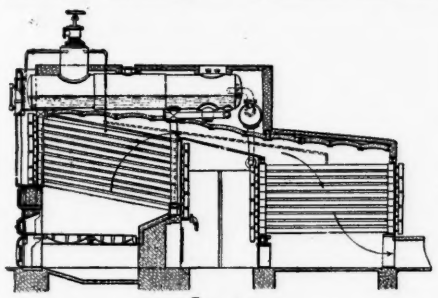


Fig. 4.

measure its velocity. This boiler is shown in fig. 1, and is of peculiar form. The outside is conical, rounded at the top, and has a cylindrical dome of much smaller diameter than the top of the boiler proper. The diameter of the boiler shell at the top and bottom is 41⅝ in. and 66 in., respectively, and the height is 13 ft. 4⅛ in. The firebox is cylindrical, and is divided for about two-thirds of its height by sector-shaped pockets secured to the upper tube sheet by the tubes, 90 in number, 3.1 in. in diameter and 5 ft. long. The products of combustion pass between and across these tubes and through open-

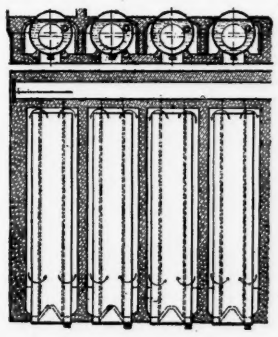


Fig. 5.

ings in the side of boiler to a space between the boiler and covering. By partitions properly placed they are then directed first downward, then up, and finally discharged near the top into a chimney or other smoke duct. The temperature of the gases and samples for analysis were taken just before they entered the smoke duct. This test was carefully overseen, but the regular fireman was on duty.

Second Test.—This was with a Lancashire type of boiler with two fire tubes each crossed by three Galloway tubes (see fig. 2). This boiler was almost new, 21 ft. long and 79¼ in. in diameter. The fire tubes were 33 in. in diameter. The gases, after traversing the fire tubes, returned through the flues on either side of the outside shell, almost the entire length of boiler, thence down and back through the center flue directly underneath. This boiler was supplied with a Perret grate, the bars of which were very narrow and of great depth. The lower part of all grate bars was immersed in water. The draft was forced and supplied by a fan into a closed ash pit. Column 2 of the table gives the results of the test.

Third Test.—This trial was of a small stationary boiler in the Laboratory of the University of the College of London. It is of a special locomotive type with firebox of oval section with water bottom (see Fig. 3). The cylindrical part of boiler is 67.1 in. long and 36 in. in diameter. There are 34 tubes 3¼ in. in diameter and 72 in. long. The total capacity of the boiler is 55.8 cu. ft., of which 29.8 cu. ft. is steam room. The area of surface of water at normal height is 29.28 sq. ft. Column 3 of the table gives details and results of the test.

Fourth Test—Was of a Naeyer water tube boiler. This boiler is shown in fig. 4, and is composed of three parts: First, 40 water tubes inclined 12 deg. from the horizontal. Second, a cylindrical part above the water tubes, forming a steam and water reservoir. Third, a system of water tubes placed horizontally behind the boiler, forming in reality a feed water heater. This boiler exposes a large radiating surface, which is entirely inclosed in brick work.

The boiler was run to almost its maximum capacity during the test, part of the steam produced being used to run an engine, part allowed to escape. Samples of

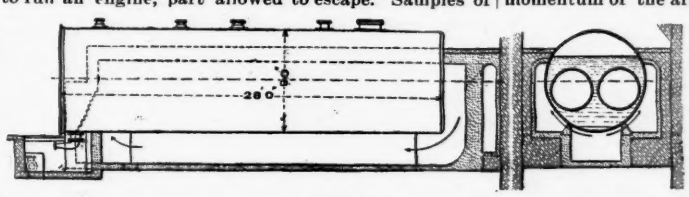


Fig. 6.

the products of combustion were analyzed from the firebox, the flue between boiler and heater, from the heater itself, and from the flue leading to the chimney. A large surface of brick work was exposed to the gases in the setting of this boiler, and there was found to be considerable leakage of air through the walls. This was shown by the relative amount of CO_2 in the gases, diminishing from 14 per cent. above the grate, to 7⅛ per cent. beyond the heater. It is estimated that this leakage amounted to 92 per cent. of the total weight of gas passing through the fire.

The following temperatures were observed: Firebox, 2,740 deg.; entrance to heater, 824 deg.; leaving heater, 2,934 deg. The figures in column 4, showing water evaporated, indicate entrained water.

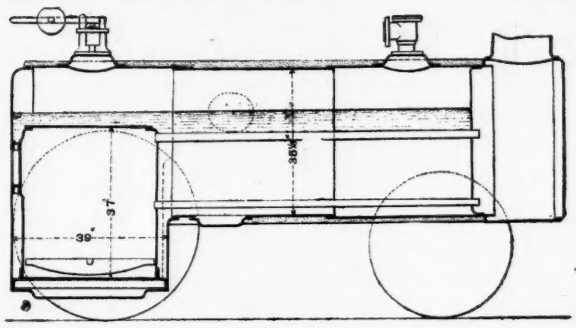


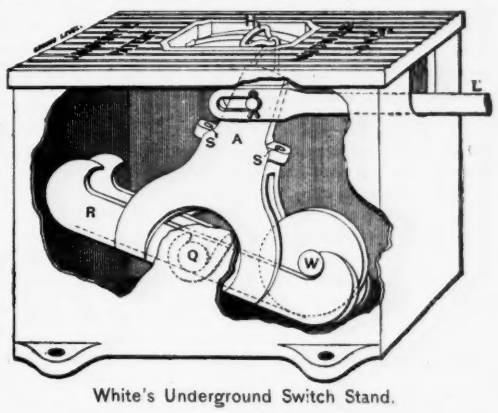
Fig. 7.

Fifth Test.—This test was made with three Cornish boilers (see fig. 5) supplying steam to an elevator pump. These boilers were ordinarily fed through a heater not used during this test. The three boilers were exactly alike, being of the Cornish type with single inside firetube and double return of the gases first on each side and finally through a flue under the center of boiler. They were 30 ft. long, 68⅛ in. in diameter with firetube 42⅛ in. in diameter, the total heating surface being 700 sq. ft. The test was made with the boilers in regular service and under normal output. Feed water was taken from the cistern of the air pump and measured by means of a gaged tank. Samples of the gases analyzed were taken from the point where the products of combustion from the three boilers united before passing into the chimney. All steam produced was used by the elevator pump which was being tested at the same time and consumed 24.2 lbs. of steam per horse power. The draft was very soft and the boilers run very light as shown by column 5 of the table.

(To be continued.)

An Underground Switch Stand.

Illustrated herewith is an underground "turnover lever box," so characterized by the English inventor and patentee, Mr. J. W. White, but it is what an American would style an undergound switch stand, its purpose being to throw the loose rails of a switch. Switch stands above ground are a source of great annoyance, and at times danger, to yard men and to teams that may have to drive about the yard in unloading cars. This device being entirely underground is not subject to these objections, and it has given excellent satisfaction in England, where it is in use. It is being adopted by several leading railroads and dock companies as well as by the British Admiralty. In the illustration it will be seen to consist of a rocking beam, *R*, pivoted at *Q*, which may be tilted by the arm, *A*, and handle *H*. On this rocking beam is a rolling cylindrical weight of 28 lbs., which rolls upon the rocking beam when it is tilted, from one side to the other. Attached to the arm, *A*, is a switch-rod, *L*, which, when the arm is thrown to the right or



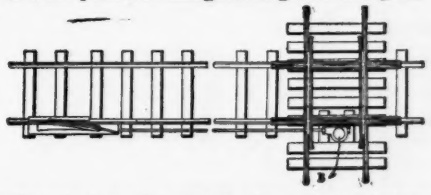
White's Underground Switch Stand.

left, is carried with it. The lever rod is slotted so that the arm may be freely moved a short distance and the momentum of the arm, rocking beam and weight, *W*, utilized against the lever rod when the switch rail is frozen or stuck fast. The rolling weight, *W*, is to insure always that the switch shall be thrown the full distance and not be left halfway open. When the arm, *A*, is thrown over, the rocking beam, *R*, is tilted and the rolling wheel, *W*, which had been at the upper end, rolls down to the lower end and with sufficient momentum to insure the arms being thrown over its full distance. The rolling weight, *W*, then gives a constant pressure against the arm and lever rod, *L*, to maintain the switch in position.

If it is desired to work this switch stand as an automatic drop-lever switch stand, a spike or bolt may be inserted into the holes, *SS*, which will confine the roller weight to either end and so cause the switch always to return to the same position. The wheel *W* rolls on its outer circumference and not upon the axle lug marked *W*, which gives it an easier and more decided motion. The Englishmen find the switch especially convenient because they can operate it while standing erect with their coupling staff. There seems to be no reason why the device should not find favor in this country, especially in cities where every foot of yards is utilized. There should be no more trouble from snow and ice in the box than is experienced in our ordinary cable car manholes. It would seem necessary that it should have good drainage; and for American service it should probably be advisable to made it somewhat heavier.

A Derailing Switch for a Street Railroad Crossing.

The engraving shown herewith illustrates a safety device made by William Wharton, Jr., & Co., of Philadelphia, for application to street railroads where they cross standard railroad tracks. A derailing switch is located in the street track about 50 ft. from the crossing, and it is operated by means of a rod from the box (B) placed in the center of the steam railroad track. The switch is normally open and before a car crosses it the conductor or other person in charge must get off and go to the



box (B) and close the switch, the operation being performed by means of a bar which he inserts in a hole in the top of the box. The bar must be held by hand while the car passes the switch, and as the operator, to do this, must stand in the path of the locomotive it is taken for granted that he will not permit the street car to approach the crossing except when perfectly safe to do so.

RAILROAD GAZETTE

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Published Every Friday.
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EDITORIAL ANNOUNCEMENTS

Contributions.—*Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies in their management, particulars as to the business of the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and railroads, and suggestions as to its improvement. Discussions of subjects pertaining to* ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

Advertisements.—*We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay,* EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and those only, and in our news columns present only such matter as we consider interesting, and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes etc., to our readers can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

The Delaware, Lackawanna & Western has ordered Hall automatic block signals for the Morris & Essex Division (half-mile blocks from Hoboken to South Orange, and 55 signals in all), and President Sloan says that these signals will be put in, fifteen or twenty miles at a time, throughout the main line from New York to Buffalo. Track-circuits will be used, and Mr. Sloan says that the Hall signals have been adopted after careful investigation of all systems in use. This reformation, though tardy, is complete. From being the most thoroughly wedded to old methods the Lackawanna takes a bolder step than any of its neighbors; that is, it adopts for its entire line what may be called the newest signal. But the Hall track-circuit, though comparatively new, embodies the results of the long experience of that company with its wire-circuit signals, and the records thus far made with the track circuits on the Illinois Central, Central of New Jersey and other roads show a certainty of action which has never before been obtained.

The London *Economist*, which deservedly carries great weight in commercial and financial circles, has an article on "The Merits and Demerits of American Railway Bonds" in its issue of Jan. 27, which it begins by saying: "If investors had not, as past experience proves, extremely short memories, there can be little doubt that in future little, or none, of their savings would flow into American railway shares; well secured mortgage bonds would chiefly attract their attention." It thinks, however, that their recent unfortunate experience will not probably have a permanent influence, and it proceeds to show that American bonds, even, need scrutiny, and points out the inherent weakness of income bonds, when there is no fixed rule to determine what may be included in expenses, and therefore what must be regarded as "income" and available for interest on such bonds; and the peculiar situation of the Erie second consols, the holders of which can do nothing to enforce their lien, when interest is not paid, for three whole years. All this seems elementary; but it is nevertheless truth of the kind that has to be insisted upon continually; for every year develops a new army of investors who seem as innocent as babes unborn of the most obvious precautions to be taken in trusting other people with your money. In fact, however, the purchasers of the doubtful securities, American and others, are doubtless for the most part much less innocent than we are apt to assume them to be, and are quite aware when they buy shares and inferior bonds that they may fall greatly in price. What leads them to buy such paper is their belief at the time that the chances are in favor of their rising in price, at least before they fall. We make a great error when we assume that nearly all those who buy $1,000 or $10,000 worth of low-priced shares or bonds do so only because they hope for the interest or dividends paid at the time. A very, very large share of them are more tempted by the hope and expectation of a rise in the price than by the rate of interest; and a very considerable number regard the securities when they buy them as so unsafe that they fully intend at the time to sell them again after no very long time. There are many hundreds of millions of American railroad bonds, and no inconsiderable amount of shares, which are as safe as such securities can well be in a country where railroad construction is perfectly free; but these yield a low rate of interest, like all securities which are regarded as perfectly safe, and if English investors are large holders of them we hear very little of it, as indeed they have no occasion to make themselves heard, having no fault to find. But Englishmen, like Americans, are very fond of getting a 4 per cent. bond at 70 which will be worth 90 by and by, or a non-dividend paying stock of 50 or less, which in a year or two will pay good dividends and be worth 100 perhaps. There is nothing immoral in this desire, and it does not excuse any maladministration or misrepresentation in our railroad companies, but it is well to bear in mind that such investments by their nature are to a large degree speculative, and that when traffic takes a turn decidedly for the worse, and the bad condition lasts long—events inevitable occasionally in every prosperous new country—lossess are as inevitable on such investments as profits would have been if there had been continued prosperity.

The *Economist*, commenting on the passing of the Louisville & Nashville dividend, and the statement that the accounts showed a surplus for the half year of 2.1 per cent. on the stock, makes one remark which ought to be printed in large letters and posted in a conspicuous place in the directors' room of every American railroad company: "*A dividend is not earned until the money is actually in the treasury.*" This is a maxim which most of our companies do not even pretend to observe, and by the neglect of which they have not infrequently led themselves into serious difficulties, and still more frequently misled the public. In fact they have so accustomed the public to the policy of paying dividends, when once begun, though they have invested the profits in additions to the property, or even have not made profits enough, depending on making more very soon, that very likely if they were to confine themselves all at once to dividing the balance of profits which they have actually on hand, their credit would suffer a shock at first, though thus only can they avoid much more serious and more frequent shocks in the long run. "Book debts are an asset, no doubt," says the *Economist*, "but to treat them as a distributable asset before they are collected is a vicious sort of accountancy." That is certainly true, and a truth disregarded in high quarters in this country.

In our last issue we reported some tests of a compound and a simple locomotive on the Long Island road, and discussed the chief features of the matter in an editorial article. One of the main points at issue in these tests is that concerning the lower pressure carried in the simple engine. This we explained in an editorial, but it may be worth an additional word, as a correspondent writes as follows:

> The tests made on the Long Island Railroad, of the Baldwin compound, have been sent out in pamphlet form by the Baldwin Company as indicating the superiority of their compounds over single expansion locomotives. On the face of the results it would appear that the compounds saved 37 per cent. of fuel, and it is said in the report that the conditions were the same. So far as I can learn the conditions were equal, except in one essential poiut, and in that point there was a wide difference which militated against the simple engine; that point is the steam pressure. The compound carried 180 lbs., while the single expansion engine had but 145. Now, wherein is the justice and fairness of such a difference and of what value are tests made with so great a difference in pressure?

Our correspondent has asked a question about which discussion might be continued to the end of time without reaching a conclusion unless experiments were made to determine what is the most economical pressure for single expansion locomotives. This point is one of the many disputed ones which have led the *Railroad Gazette* to encourage shop tests of locomotives. So far as is known at the present time greatly increased pressures with single expansion stationary engines are wasteful, and multiple expansion engines are required to gain the greater theoretical efficiency of high steam pressures. Many experiments have been made with stationary engines which shows this. Perhaps the most conclusive of these tests are those of Willans, published in the *Proceedings* of the British Institution of Civil Engineers in 1892-93. The limit of economical increase of steam pressure for single expansion engines, as shown by those tests, is lower than the pressure carried on the single expansion locomotive in the Long Island tests. It is such facts as this which give the only justification that we know of for using a lower steam pressure on the simple locomotives. The tests were made to determine the comparative efficiencies under a fixed service, and it may be that, had the tests been made to determine which is the best "all round" engine for handling trains on time and in bad places, the simple locomotive would have been at a great disadvantage in having a lower steam pressure. That is to say, while practically it may be greatly to the disadvantage of a single expansion locomotive to have a lower steam pressure than a compound, yet, on the basis of efficiency only, with fixed and reasonably easy conditions to meet, the lower steam pressure may be conducive to better economy with the single expansion engine; but all this is speculation. The justice of using a lower steam pressure for the single expansion engine can only be settled by experiment, and argument is of little value. We believe it would have been very much better, and more satisfactory to all concerned, if the steam pressure had been the same in both of the engines tested on the Long Island; as it is, all that can be said is that under equal conditions, *other than the steam pressure*, the Baldwin compound showed a very great saving.

In a most interesting paper before the Western Railway Club, extracts from which were given in the *Railroad Gazette* last week, Mr. Godfrey W. Rhodes, Superintendent of Motive Power of the Chicago, Burlington & Quincy, has given more information about the practical maintenance of air-brakes in service than has before appeared. The entire paper should be read by all who are interested in the subject, and copies can be obtained from Secretary Cloud at the Rookery Building, Chicago. The important facts developed by Mr. Rhodes are that air-brakes to be useful must be closely watched, and cleaned as often as the condition of each particular service demands, and that the necessary maintenance can be provided without great expense. He makes it plain that incomplete inspection will cause more trouble with air-brakes than anything but a badly designed triple valve. Triple valves do not fail by wearing out of important parts, but become inoperative from lack of cleaning. This has led to the conclusion, by some who have investigated the subject, that the time is not far distant when a triple valve that has not been cleaned and is not working freely will be rejected at interchange points. This may be considered in revising the Rules of Interchange this year. It is an imposition for one railroad company to force the maintenance of its air-brakes upon connecting lines, as is too frequently done by those roads which do not use the air-brakes in freight service, and therefore do not provide air-brake inspectors and repairers for freight trains. The rules for inspection and rejection of air-brake triples at points of interchange must be carefully considered. Mr. Rhodes says: "Not only should railroads be able to determine what constitutes the essentials of the first-class brake, but, having applied them to their cars, they should see that sufficient force is hired and facilities provided to properly maintain them. Hanging the hose in the present dummy coupling as a remedy to prevent sand and dirt is open to much criticism . . . Many an air brake car has been allowed to run for months with its brakes cut out and nothing really the matter with it. . . . The extra expenditure of money for brakes under freight equipment must not be allowed to rest there. Much has still to be done in providing proper facilities for maintaining them." These are important suggestions, and the discussion of the paper this month at the Western Railway Club promises to be a very lively one.

Railroad Relief Associations.

We print in another column the substance of an attack made on the Relief Department of the Chicago, Burlington & Quincy Railroad. This department, as most of our readers know, is a mutual benefit association, organized by the railroad company, through which employees insure each other against losses incurred by injuries received in the service, and also maintain something like a regular life insurance association, the railroad company contributing material assistance.

This organization, in its main features, is similar to those established on other roads, notably the Baltimore & Ohio, the earliest to start anything so comprehensive, the Pennsylvania and the Philadelphia & Reading. The criticisms in the article we print apply with approximately equal force as against the practice of these other roads, and we therefore publish it as a matter of general interest. We have no knowledge as to the precise equity of the specific charges against the Burlington road.

Employees who are inclined to find fault at the man, agement of an association of this kind should note the fact, which is plain to all, that the company does them

no injustice in the management of the affairs of the association unless there are wrong methods or extravagance in details; for the beneficiaries get all the money that is paid into the treasury, and in the case of the Burlington they have got a little more than that. A member may complain to himself that he is doing good to his fellow-employee on a larger scale than he ought to, but he cannot say that the company gets any benefit from his expenditures. On the Pennsylvania, as will be remembered, there has been accumulated a considerable reserve fund, but this is held for the benefit of the employees, and the conditions under which it is to be used are well understood.

The central point of the attack on the relief plan is concerning the clause under which the employee releases the railroad company from liability for damages in case he is hurt. But on careful reading it will be seen that this release, after all, is a very one-sided one, *in favor of the employee.* Under it a member joins the association and continues to pay his monthly dues until he is hurt; then if he decides that the company is legally bound to pay him damages on account of his injury he can at once give up the money benefit which is due him and demand damages in the usual way. In practice it is about like this: A brakeman is injured: the benefits likely to accrue to him from the fund will aggregate, say $200, or $300, or $500; but he thinks, or some lawyer who has gained his confidence thinks, that a suit can be entered in court and the jury convinced that the railroad company is to blame for the injury and can be made to pay $5,000. A suit for, say, $10,000 is therefore entered; and, as juries go, a good sum is likely to be recovered. If, on the other hand, an injured man secures wise and disinterested advice, and finds that the railroad company is not legally to blame for his injury, he accepts the money due him from the association, and thus receives a substantial benefit where, otherwise, he would receive nothing at all, unless the company or his fellow employees chose to grant him a gratuity.

In view of the universal experience with cases of this kind, the great numbers of lawsuits in which railroads have to pay considerable sums, or which they see fit to compromise, where there is really no just liability, simply to avoid worse punishment, it would be hardly unfair to say that the $38,000 spent by the Burlington annually is not to avoid the payment of just dues, but rather for the purpose of diminishing the number of lawsuits under which the payment of unjust claims is forced. It is true that the employee recovering a verdict of, say, $5,000, can answer that the company has collected from him a certain amount of insurance money (that which he voluntarily gave up so as to get his $5,000) which he has now lost. But even then he can reflect that his money has gone, not into the pockets of the hated capitalist, but to benefit his fellow employees. And he has all along received the benefit of his insurance against that class of accidents for which the company is not liable, and also, if the insurance covers death from ordinary causes and disablements due to ordinary sickness, he has had the benefit of that also.

The most plausible claims in the argument against the road are those concerning the non-voluntary character of the agreement, and the constitution of the Advisory Board. We presume it is true that the road tries to increase the membership of the department. Probably, also, an employee who belongs to it is more likely to be promoted than one who does not. A number of candidates for employment would probably find that those who most promptly and intelligently accepted this condition would stand the best chance of getting a place. At first sight this has the appearance of injustice; but, after all, we are not sure but it is equitable. The company imposes, or attempts to impose, the condition, not for the sake of defrauding the employee, but for the purpose of securing a man who will have an extra incentive to remain with the company. The employee, if he cares nothing for the insurance, may fairly look upon the arrangement as if he were accepting a reduced rate of pay for the sake of securing a firmer tenure of his position; and it is by no means certain that he does not get full value for the sacrifice he makes.

So far as we can see, the most palpable injustice is found in the unscientific classification, by which an employee who is not much exposed to injury is placed on a level with brakemen, engineers or firemen, whose employment is specially hazardous. By thus lumping a large number of employees in one class, those in the less hazardous employment pay far too large a share of the cost of insurance.

The Advisory Board is so made up that the railroad company always has a majority of one in its favor; but, on the other hand, the railroad company is the only party that makes a large outlay without definite return. The Board, however, is composed of a sufficient number of men so that the employees certainly ought to be able to put in a very loud protest in the case of any unjust action, and we should say there ought to be a good probability that some one or two of the members appointed by the road would protest against any marked injustice.

Steel in Car Construction.

Periodically the railroad clubs return to the discussion of the use of steel in car construction, with the result each time of making a slight step toward the inevitable use of steel underframes for freight cars. At the present time the experience in this country with metal cars is about as follows: The New York Central, the Lake Shore & Michigan Southern, the Norfolk & Western, the Pennsylvania, the Chicago, Milwaukee & St. Paul, the Philadelphia & Reading and a few other railroads and the Union Tank Line have had some experience with metal underframes. The single uniform result of this experience is that such underframes are apparently more durable and stronger than wooden underframes. The almost universal experince has been that errors in the original designs have led to the failures that were predicted before the cars were put into service, as in the case of the tubular car frames. It was predicted that the cost of repairs would be greater with the metal frames, but nevertheless from all that has been done it is pretty well settled that metal underframes are stronger, more durable and require less repairs than wooden underframes. This conclusion is a long step in advance.

The great bug-bear—the difficulty of repairing metal underframes after wrecks—must now be caught and caged. Some few roads have settled this point already by an investigation into the relative cost of all of the freight-car repairs due to wrecks. Such investigations have uniformly shown that the entire cost of repairing wrecked underframing is a small sum, and but a fraction of the saving that would follow if metal underframes were used, and were to give generally the saving in repairs to draft rigging, end sills and body bolsters, that has been found in the experience with the better designs that have been tried. As one railroad man has expressed it: "We purchase cars to run and wear out and not to be destroyed in wrecks. The percentage of wrecked cars is exceedingly small, and the designer should have in view principally the reduction of the cost, inconvenience and loss of time resulting from repairs, and consider the question of repairing after wrecks as secondary. Probably, when a car is so well constructed that it will be more durable, it will be found that it will be less damaged in wrecks."

Railroad men need not be told that steel is more durable than wood, or that steel can be used in its commercial forms with but little or no alterations to replace the wood in freight-car underframes; that matter is settled. The information wanted is the following:

(*a*) What will be the additional first cost incident to the use of steel?

(*b*) Is an additional expenditure for steel justified in view of the fact that the designs and sizes of freight cars have been changing very rapidly in the past 10 years?

(*c*) Is it probable that the near future will bring changes in freight-car dimensions that will prevent obtaining the full advantage of the greater durability of steel underframes?

Some of these questions can be answered now, based on the reasonable expectation of continuance of the present market price of steel. Rolled steel beams can be purchased in large quantities for car underframes, at a price not much greater than the price of steel rails; and leaving aside all unnecessary elaboration of details, and all questions of patents and royalties, for there are no fundamental patents on this construction, the additional cost of a metal underframe, of simple design, need not be more than $50 a car. What is more important is that the use of steel center sills at the present price will give most of the advantages that would result from the use of complete steel underframes, with a cost per car no greater than for complete wooden underframes with the best class of draft attachments. That is to say, the use of steel center sills will give such draft rigging and stability to the car as will insure the main advantages that could be obtained from a complete steel underframe. This, to a considerable extent, answers the question of cost and the justification of use in view of possible changes, as it is clear that the same cost will give greater durability.

As to the changes which will be demanded in the future in freight car dimensions there is not much uncertainty. The limit of sectional area is now practically reached and any increase must be mainly in the length. Much increase of length is not probable, as the majority of freight cars at the present time will carry all but unusual freight, and special freight should be, and probably always will be, carried in special cars. Mr. Theodore Cooper, in a recent paper before the American Society of Civil Engineers, has presented some very excellent argument on this subject, showing that the limit of freight-car dimensions is practically at hand. The discussion of this subject before the New York Railroad Club in January developed that there will probably be no great changes in the dimensions of freight cars in the near future. There may, however, be a demand for cars having greater carrying capacity, but the introduction of steel furnishes this additional capacity incidentally as the steel underframe, when made strong enough to withstand the shocks of service, can carry a load of 100,000 lbs. with greater safety than the present wooden construction can carry the common load of 60,000 lbs.

It is highly probable that the striving for decreased repair expenses on railroads, and the present investigations into the causes of the delay to freight at inspection points, will soon lead to a more serious consideration of this subject than it has had before in this country, and there can be but one result from such an investigation.

Those who are interested will find much useful information in the Proceedings of the New York Railroad Club and of the Western Railway Club for January of this year. A synopsis of the papers and discussions was given in the *Railroad Gazette* of Jan. 12 and Feb. 9. Those who care to go further and learn what has been said in detail about this subject will find in the files of the *Railroad Gazette* a complete statement of what has been done as follows: 1889, page 345; 1890, pages 763 and 771; 1891, pages 307, 499 and 900; 1892, pages 79, 98, 155, 171, 514 and 582; 1893, pages 432 and 453.

The Union Pacific Injunction Against Strikes.

Following hard upon the injunction granted in December by Judge Jenkins at Milwaukee against the strike which the Northern Pacific employees were alleged to be on the point of making, comes the order of Judge Dundy, of the United States Circuit Court at Omaha. Few announcements of judicial action have occasioned such storms of criticism as this order of Judge Dundy. Labor circles have been much agitated, and Judge Dundy has received anonymous threats by letters adorned with the usual skull and crossbones, while Judge Jenkins has earned the distinction of a resolution which has been offered by Congressman McGann, Chairman of the Labor Committee of the House, to investigate his action, with a view to impeachment. The Western press has fairly teemed with unfavorable comments on these proceedings, and if we are to judge from interviews with prominent labor representatives, who undertake to state exactly what was decided by the learned judges, as well as the effect of such decisions, we are bound to conclude that unwarrantable encroachments have been made, not only upon the rights of railroad employees, but of all other employees in the country. But there are some extravagant claims that suggest that somebody has inferred too much. We have been inclined to think that courts of equity were getting broader and more liberal every year in enforcing the rights of all suitors, whether employers or employees, and that our judiciary set store by nothing so much as the desire to reach substantial justice between man and man without the hindrance of technicalities. We have been observing this development, as we estimated it, for some years, and while we have had occasion to note instances where an equity judge has, in our opinion, made an error, the exception has seemed rather to prove the rule than otherwise.

The present developments do not shake this opinion. If the order of Judge Jenkins was *ex parte*, it was issued rather as an order to show cause, than the deliberate decision of the court. If *ex parte*, it contemplated an early return day, when the men would have full opportunity to be heard, and to show the error of their opponents' position. Such orders are as often set aside as they are confirmed, and are chiefly used to bring parties into court on short notice, when the emergency is such as to warrant suspension of the usual notice. If the men disregarded the return day by omitting to attend and contest, a confirmatory order would issue as a matter of course, as upon a confession of its justice. We are not advised of the exact proceedings before Judge Jenkins, but his order, as reported, seems to us to have been too broad in its phraseology, and of course may not have been justified by the real facts of the case; but, as we said at the time, the question may never be brought to an

issue; the men have come to an agreement with the Receivers.

In the Union Pacific case we have better opportunity to review Judge Dundy's action, and ascertain its nature and effect. The facts in the case do not appear to have been disputed. The road has lost business so fast that the reduction in earnings was absolutely alarming. The Receivers alleged that the wages were in excess of any paid by any other railroad similarly situated, and were fixed on a basis which no longer exists, such as that the road ran then through a wilderness where good men were difficult to get, and wages everywhere were higher than at a later period, aside from the present commercial depression. And this does not appear to have been denied. Leave was given to all employees to terminate their employment at any time, or to come into court individually or collectively, to protect their rights or correct any wrong.

The language in some portions of Judge Dundy's order, if dislocated from its connections and general tenor, would seem to forbid strikes or any proceeding which would hinder the operation of the road in the Receiver's hands, however legitimate such strikes or proceedings might be if there were no receivers in the case. But such a construction is not only unnecessary, it is inconsistent with the trend and purpose of the order. Such language is often found in injunction orders, and is designedly used to carry out the spirit of the injunction in cases where, if less specific language were employed, shrewd opponents could evade and defeat justice on a matter of construction.

Moreover, this conclusion is sustained by Judge Dundy's own utterances. So persistent and bitter have been the attacks upon him on account of this order that he has deemed it proper to state to the public that he had not made any order prohibiting strikes or prohibiting the men from resorting to ordinary and legitimate proceedings to get as high wages as they can. The effect of his order, by his own construction, is substantially that it justifies the Receivers in making a reduction which is not unfair to the men and is absolutely necessary as a matter of business.

There may be some question whether in ordering the reduction sufficient opportunity was given the men to present their side of the case, but they certainly have not emphasized this omission. They have placed their objection apparently on the ground that reductions should not under any circumstances be made. And if the Court were in error in this particular an application for rehearing would no doubt be favorably entertained, or the order reversed on appeal.

Indeed, Judges Hallett and Riner have signified, according to recent press dispatches, their unwillingness to enter in their jurisdiction the order that Judge Dundy entered in his, on the ground that the men have not been allowed sufficient time to confer with the Receivers, so as to reach an amicable agreement in the matter. These judges are doubtless proceeding with all the more caution, and commendably so, in view of the clamor against Judge Dundy's order. These are matters of detail which it is impossible to settle in advance of evidence to be submitted.

On the whole case, we think there lies at the bottom of these orders a principle legally just and ethically correct, as we have pointed out. Whether it needs application in any particular state of facts or not must always be a question of good judgment and fair play. The railroads have duties to the public as well as to their stockholders and bondholders, and all of their employees share more or less in these public responsibilities.

Compressed Air and Hydraulic Power in Shops.

The circular from the Master Car Builders' Committee on compressed air appliances and hydraulic machinery, which we published last week (page 112), should bring out considerable information valuable not only as a record of the progress, in the United States, in the uses and applications of these two comparatively neglected but useful and practical branches of engineering, but also for the suggestions likely to influence future practice. Each of these agents for the transmission of power has, with one notable exception in each case, attained a more extensive use in some European countries than in the United States. These exceptions are the air-brake and the hydraulic elevator. Each of these has been brought to its present state of perfection by American ingenuity, and each is gradually gaining a foothold on the other side of the Atlantic.

With these exceptions and possibly some others of minor importance, supremacy in the scientific application of these agents has not thus far been with the engineers of this country, but the past few years have witnessed considerable progress. There is now scarcely a shop in the country that does not use compressed air for some purpose or other, while hydraulic power is universally recognized as a convenient and reliable method of operating riveters, punches, cranes, elevators and drop tables, and is gradually gaining public favor. The use of hydraulic presses is attracting considerable attention, and the Bethlehem Iron Works Company has recently installed a number of presses ranging in capacity from 1,500 to 14,000 tons, to be used in the manufacture of shafts, armor plates and other heavy forgings. It is found that with these presses forgings of a more uniform density can be produced than by the use of a hammer, as the flow of material is necessarily slow and it adjusts itself better under a steady heavy pressure than under a lighter hammer striking a blow. While such large presses will probably never be used in a railroad shop, the principles underlying the reasons for their use are constantly met with. The same principle is involved in the driving of a rivet. A constant, heavy pressure, as of a hydraulic riveter, more completely fills the hole, all other things being equal, than repeated light blows.

In the use of compressed air this country is at a disadvantage, so far as actual experience is concerned, as compared with European countries. The large central stations for compressing air, with mains laid about the cities, in Paris and Birmingham, have given an impetus to the use of compressed air in Europe that could probably be paralleled here only under similar favorable conditions. A company has been formed in Chicago for the installation of such a plant and to lay mains short distances, though on the whole it can hardly be said that the plan promises the great relief from smoke and other annoyances held out by those interested in the company. An article in the November number of the *Engineering Magazine* on the "Widening Use of Compressed Air" is full of suggestions as to the present uses and future possibilities of this power, and it is fair to assume that the members of the Master Car Builders' Association will in their turn offer much of value along this line.

A settlement of the trans-continental freight and passenger rate war appears to be as far off as ever. The only progress that has been made is the adoption of a trackage agreement between the Northern Pacific, Great Northern and Canadian Pacific. Under the terms of this agreement the Canadian Pacific obtains access to Puget Sound points and to San Francisco via the Shasta route; the Great Northern obtains a similar privilege over the tracks of the Northern Pacific to Tacoma and Portland; and both the Northern Pacific and Great Northern obtain entrance to New Westminster and Vancouver over the tracks of the Canadian Pacific. In return for these concessions, the Canadian Pacific has withdrawn its demand for differentials to Puget Sound points. This is as far as the joint agreement has become operative.

As regards the San Francisco business, the Canadian Pacific was inclined to modify its demand for a differential to San Francisco; and the Northern Pacific, Great Northern and Canadian Pacific fixed up an agreement among themselves, which was submitted to the Western Passenger Association, with the request that the Association shrink the proportional rate from Chicago to St. Paul $5, which was promptly declined, as such action would seriously interfere with Missouri River rates, but an offer was made to consider any basing rate that might be tendered from St. Paul. Subsequently the Canadian Pacific offered to withdraw its demand for a differential for three months if it could have 4 per cent. of all California business. The Western Passenger Association promptly agreed to see that the C. P. had this proportion all the time by giving it sufficient controllable immigrant business. This was not satisfactory; and the matter now rests with the Canadian Pacific people, who have been asked to formulate their demands for presentation to the regular meeting of the Association next week. In the mean while the Union Pacific, that has not been a party to any of these conferences, threatens to take matters into its own hands by the payment of commissions unless the other lines come to an agreement soon. The Atchison is becoming exceedingly impatient also and does not hesitate to state frankly that unless matters mend soon it will also take a hand in the settlement. The latter company, however, is a member of the Association and would much prefer to see an amicable settlement arrived at between the other factions.

The bill to permit and regulate traffic pools among competing railroads which Senator Gorman has introduced in Congress is somewhat different in detail from those presented in previous years, the details having been changed by careful hands. The bill wipes out Sec. 5 of the Interstate Commerce Law and inserts in its place an entirely new paragraph. The contracts with which the bill deals are referred to as contracts "enforceable between the parties thereto." In case the Interstate Commerce Commission neglects to act for 10 days after the filing of a contract with it, the same shall be deemed approved, unless the Commission makes an order formally withholding approval. Such approval "shall be withheld" whenever the commission "finds" that the contract will work injustice or result in inferior service. The orders and findings of the commission shall be subject to review by the Circuit Court upon petition filed by any party to the contract or any person affected by it. The decree of the Circuit Court may be appealed to the Supreme Court, where it may be advanced for hearing as in the case of appeals in which the government is a party. The Commission must observe the working of pools, make investigations where necessary, and order the roads to modify or correct wrong practice, specifying wherein the contract produces injustice. Such orders are to be enforced the same as other orders made by the Commission—which means that the Commission will have to go into court and fight for its rulings on their merits. The Commission has had a hard time of it in fighting for the law heretofore, and now, if it must give particulars to show wherein the maintenance of rates by a pool works injustice, it will have still greater difficulty. To prove such a claim in court it will be necessary, practically, to prove that it would be a good thing for railroads, working peacefully under a pool, to go back to rate cutting—rate cutting of the kind which resembles throat-cutting. But as there is little likelihood that pools would work injustice in any event, and as the law is as yet unborn, perhaps it will not be well to speculate any further at present.

We print in another column a sort of prospectus of the Air-brake Men's Association. It is not very well known that an association of railroad air-brakemen was organized in Pittsburgh last June, and many who have known that the organization was formed have not been told of its purposes. It is simply an extension of the primary idea of air-brake instruction. Considerable education and experience are required to make a mechanic really useful as an air-brake inspector or instructor, and it is expected that higher education will be promoted by the papers and discussions presented at the meetings of this association. In this way it is hoped that the experience gained in actual service on one road can be utilized on others, the medium of exchange being this organization. One of the specific objects of the association is "to encourage the adoption of a uniform method of instruction and maintenance of air-brakes which will enable their use to the maximum efficiency." The Master Car Builders' and Master Mechanics' associations deal with the subject generally, but this association will give attention to details. The range of membership in the association includes all, from the top down to the car repairers, provided the applicant can show that he understands air-brakes. Many who are not eligible to the Traveling Engineers' Association, which has been recently formed to promote good locomotive operation, are eligible to the air-brake association. The first annual meeting will be held in Columbus two months hence, and papers will be read on air-brake instruction, on maintenance of freight and passenger brakes, on the cleaning of triple valves and brake cylinders, on air-pump repairs and on the handling of freight and passenger trains. These papers are now in preparation.

The St. Louis, Kansas City & Northwestern, which is that part of the Burlington route from St. Louis northward to Burlington, Ia., has for about two months been running a dining car, in which meals are served by the card; and the experiment thus far seems successful, though not to such a marked degree that the new plan will be generally adopted by the company until it has been tried on a larger scale. Between St. Louis and Burlington breakfast and supper are served by the card, and dinner also; but dinner is also served on the table d'hôte plan. The result, in brief, is that the number of customers is much larger than before, the gross receipts somewhat larger and the expenses about the same. For the month of January the number of persons served was 60 per cent. above the former normal number, and the average price received per meal was 62½ cents, making the gross receipts the same as before. The fact that the expenses do not increase with the number of customers illustrates the fact that the service constitutes a very large share of the cost of running a dining car.

One of the signs of the condition of affairs in New York is the earnings of the elevated railroads. These have increased almost continuously from the beginning, not very rapidly, but constantly, with the growth of the city; and it is not easy to see how it could be otherwise, as they furnish the only available means of rapid transit, and are available practically to the whole of the city south of the Harlem River. Now, for the last quarter of 1893 the earnings of these lines, which had increased $128,320 (3⅓ per cent.) from 1891 to 1892, were $233,866 (eight per cent.) *less* than in 1892. It is possible that the Broadway cable railroad has diverted a portion of the travel, though it had begun working already in 1892, and is very far from affording rapid transit, which is simply impossible on the surface of a crowded street like Broadway without almost daily slaughter; but most of it must be due to dull business, and the enforced economy of many in such things even as five-cent fares. Two of these, it must be remembered, will buy a loaf of bread.

NEW PUBLICATIONS.

St. Louis Railway Passenger Traffic.—This is the title of a paper read before the Commercial Club of St. Louis by Mr. George Bridge Leighton, and printed in pamphlet form by order of the club. Mr. Leighton is Pres-

ident of the Los Angeles Terminal Railroad, and has studied his subject intelligently. His main points are to show that the railroads running from St. Louis to Chicago and to Kansas City do not take pains to adjust their time-tables so as to accommodate the public in the best manner, and to show how the East and West roads, which do both Chicago and St. Louis business give too large a share of their attention to Chicago. On any train where there is a Chicago and a St. Louis sleeping car it is easy, says Mr. Leighton, to distinguish the former by the superior character of the service on it. The criticism in regard to the trains running from St. Louis to Chicago and Kansas City is that they all start at about the same time, whereas if the several roads did not take such narrow views of the competitive principle involved they would arrange their trains so that some of them would start at earlier or later hours and thus give the public better accommodation. The material in the pamphlet is carefully arranged and discussed with discrimination.

Engineering for Jan. 26 devotes 45 pages to the description and illustration of the Manchester Ship Canal, recently opened to traffic. It includes the history of the canal, its expenditures and its commercial aspect. The canal is treated as an engineering structure in which the locks, sluices, viaducts and bridges are treated separately and in full. The excavation is treated in two chapters, one upon the dredging, the other upon the so-called dry excavations. The walls and embankments and other engineering features are each given a chapter. The illustrations are large and comprise a map showing the topographical features, another showing the industrial centers affected by the canal, and a third showing the Salford docks. Beautiful half-tone engravings are given showing the construction of the work at important points throughout its length. These include the excavations, masonry and wood and steel structures, temporary and permanent. This description is the most complete thus far published, and is in keeping with the World's Fair and other elaborate articles which *Engineering* has published.

Journal of the Association of Engineering Societies.—The last issue of this periodical for 1893 has come to hand, and it contains the following papers: "Experiments on the Compressive Strength of Steel Hoops," by Charles H. Benjamin; "Reconstruction of the Burlington Bridge," by George S. Morison; "The Ferris Wheel," by William H. Searles; "Some Notes on Irrigation," by A. M. Van Auken; and "The Hinged Suspension Bridge," by M. A. Howe. The volume also contains the usual index to current engineering literature, being a summary of that published in successive issues. The transactions and proceedings of the societies in this Association have been particularly interesting during the past year. In fact the year has furnished to the engineering profession an unusual amount of literature upon technical subjects, due in part to the World's Congress at Chicago, which brought out a great many papers that otherwise would not probably have been published. The *Journal of the Association of Engineering Societies* has contributed its full share to these publications,

What an Engineer Should Know About Electricity. By Albert E. Clough, E. E. Boston: The Mason Regulator Company. Pages 108. Price 50 cents.

This little pocketbook is No. 4 of the Mason Regulator Company's series, and contains some good practical hints and information about recent electrical machinery. It first takes up the units of measure employed to-day in electricity, and their value when expressed in other units. The different kinds of batteries are described and their application explained. Electric bells, circuits, burglar and fire alarms, gas lighting and other practical applications of electricity are also treated. The dynamo is described and the windings explained, and considerable space is given to their care. The subject of heavy current applications in incandescent lighting is treated, and a short chapter is given on transmission of power. The book concludes with the publication of the underwriters' rules and a table of resistances of copper wire.

Selected Papers. The Rensselaer Society of Engineers, of the Rensselaer Polytechnic Institute, has renewed the publication of its magazine entitled *Selected Papers* with January of the new year, Volume 2, No. 3. It contains the following papers: On the Theory of the Masonry Arch, by William H. Burr; Notes on Railway Earthwork, by W. G. Raymond; Determination of the Proper Size of a Water Main, by Wynkoop Kiersted, and Natural Asphaltum and Its Compounds, by J. W. Howard. The Society has adopted the standard size of publication, 6 × 9 in., and this copy contains 105 pages.

The Rose Technic, of the Rose Pylytechnic School, Terre Haute, Ind., sends us No. 4 of Volume 3 of its monthly periodical, for January, 1894. This contains an interesting article on Indicated Steam Consumption, by Professor Brown; Notes on Coal Mining, by B. R. Putnam, and general college news.

TRADE CATALOGUES.

The Builders' Iron Foundry, Providence, R. I., has just issued a catalogue entitled "Our Share in Coast Defense," which is 6 × 9 in., 65 pages, with many illustrations. This catalogue contains information that is not always to be had. It gives the Government specifications for the manufacture of cast iron bodies, for 12-in. breech-loading mortars hooped with steel, also for 12-in. breech-loading rifled mortars. Several pages are given to cast iron used in ordnance and to the process of manufacturing it. Another chapter is devoted to a progress report of the manufacture of this ordnance, together with the mechanical tests and limits of measurements to which the work must be brought. The machinery for casting, turning, boring and gaging pieces of ordnance are also given, together with the operating breech mechanism. The Builders' Iron Foundry is also the manufacturer of the Venturi water meter and exhibited a 36-in. meter which measured 20,000,000 gallons a day at the World's Fair. The exhibit also included two 12-in. breech-loading rifled mortars weighing 14¼ tons and costing $10,000 each.

The Burlington Relief Department.

The *Locomotive Engineers' Monthly Journal* has printed a long account of the Relief Department of the Chicago, Burlington & Quincy and its controlled lines, intended to show that the organization is operated under rules which are unfair to the employees, and, in fact, expressly calculated to deprive them of their rights, and to give the railroad company an undue advantage over them. The article is copied from the Omaha *Bee* of Nov. 5 and is headed "Fraud Unmasked." It is evidently written by some one well acquainted with the working of the association, and there are probably no unfair omissions, so far as statements of fact are concerned; but undue emphasis is laid upon those features of the agreement under which the men become members of the department, so as to create a one-sided and unfair impression. We quote the principal part of the article:

The Burlington Volunteer Relief Department is in reality a device of the railroad to prevent employees from collecting what would really be due them for injuries received while serving the company. It practically compels the employees to contribute their own funds for the protection of the company; it is a mutual insurance company operated by the road for its own benefit and supported by the employees; it has no legal existence as a corporation, and it therefore has no standing in the courts; it can defraud the employee and leave him without redress; it is an insurance company doing business outside the laws of the State; and, finally, its contracts which it requires the employees to sign are void and illegal upon grounds of public policy.

The Burlington Volunteer Relief was organized June 1, 1889. The employees contribute "voluntarily" of course, to the "relief fund." This fund is supplemented by the contributions of the company for the payment of expenses and for making up any deficiency. The relief department, is under the general charge of the C., B. & Q. The officers and agents of this company deduct the dues from the monthly wages of the contributors to the fund. All officers are appointed by the railroad company. There is an advisory board of 12 members, to whom all disputed questions are referred. The contributing employees elect six of the members of the advisory board; and to even up matters, the railroad company appoints the other six. But the company has provided an additional safeguard for its own interests by providing in the rules that the General Superintendent of the C., B. & Q. shall be an ex-officio member of the advisory board and its permanent Chairman. Thus the company guards its own interests by assuming the authority to cast the deciding vote in the event of a tie. It has adopted still another safeguard by providing that the rules and regulations drawn by itself shall never be exchanged except by a majority of the votes of the whole advisory committee. Inasmuch as the contributing members have but one-half of the members of the committee, it may be readily understood that any amendment to the rules and regulations of the department will never be made unless the amendments meet with the full approbation of the C., B. & Q. Railroad.

Rule 20 of the regulations provides: "No employee shall be required to become a member of the relief fund." In spite of the rule, it is a well known fact that the company does everything in its power to induce its employees to become members of the relief fund. It employs men for the sole purpose of soliciting employees to make application for membership. They distribute books, leaflets and circulars. Every member is given to thoroughly understand that in order to maintain his prestige with the company it will be to his interest to become a contributing member to the fund.

An innocent little paragraph in the application for membership reads as follows:

"I also agree that in consideration of the amounts paid by said company for the maintenance of the relief department, the acceptance of benefits from said relief fund for injury or death shall operate as a release and satisfaction of all claims for damages against said company arising from such injury or death which could be made by me or my legal representatives."

The above paragraph contains in a nutshell the object and sole purpose of the railroad company in organizing the relief department. The average death benefits are from $500 to $1,000. The switchman who is run over and maimed for life is entitled to draw 50 cents a day as accident benefits as long as he remains in the employ of the company, but there is nothing in the terms of his membership to prevent the railroad company from discharging him whenever it pleases after he has been injured, and there is now on file with the clerk of the Supreme Court a case in which the railroad company did discharge a man after he had been injured, even when the Superintendent had given his word that the man should remain in the employ of the company as long as he desired, and then practically violated the agreement by tendering the man a place which he was not qualified to fill.

The relief department has been a paying investment for the C., B. & Q. The employees contributed to the fund during the first three years $359,639. Out of this fund there was paid in that period for sickness and death $187,885. For accidents and death by accidents, $193,070, making a total of $380,955, leaving a deficiency of $20,275 to be made up by the company. The expenses of the department for the same period were $93,736, which amount was paid by the company, together with the sum of $1,040 as interest on monthly balances. Thus the total investment of the railroad company for a period of three years was $114,012. In other words, by the payment of $38,000 per annum the C., B. & Q. and all its associate lines insured themselves against possible outlays for damages to their employees. Considering the fact that these systems employed nearly 25,000 men, and that a frightful number of accidents are reported every year, the insurance comes dirt cheap.

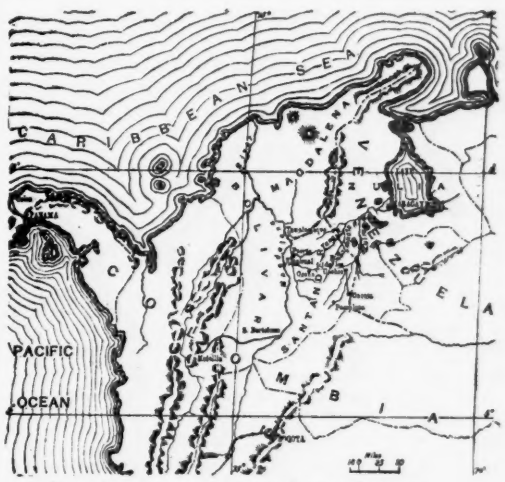
The B. & M. can well afford to pay $38,000 even to insure itself against liability for damages on its Nebraska lines alone. For the year ending June 30, 1892, the official record of employees killed and wounded on the B. & M. in Nebraska was as follows: Firemen killed, 11, injured, 21; switchmen killed, 5, injured, 19; other employees killed, 7, injured, 9; total killed, 23; total injured, 49.

The writer then goes on at considerable length to detail lawsuits which have been entered in the courts of Nebraska by employees, who have been injured in the service of the road, and have been dissatisfied with the treatment they received from the Relief Department. It is said that there have been a large number of these cases. Those here described throw little light on the right or wrong of the policy pursued by the railroad company. Extended accounts are given of the disappointment felt by the friends or heirs of persons injured or killed when they found that their benefits were not so large as had been expected or that the railroad company is not legally liable for the injuries. The opinions of experts are quoted to show that the Relief Department, being a mutual insurance company, is operated in violation of the laws of Nebraska, and it is claimed that the railroad company takes advantage of the anomalous legal status of the department to perplex suitors in the courts.

A Railroad from Cucuta to Tamalameque.

BY J. T. FORD, ASSOC. M. INST. C. E.

In view of the interest attaching to the problem of the great Inter-Continental Railroad, it is perhaps opportune to give to the readers of the *Railroad Gazette* a description of a railroad project which I was engaged to investigate some months ago in the Republic of Colombia, South America, namely, the proposed railroad from San Jose de Cucuta northwest to Tamalameque on the Magdalena River; since, if built, it would undoubtedly form a very important link in any great system



Part of Colombia, Showing Cucuta Railroad.

connecting North and South America, reducing somewhat the length of such line ultimately to be built through new country, which at present shows but little promise in the way of immediate returns on the investment if undertaken as a whole. It is the view of many that in this way alone can the great line be considered within the range of practical enterprise; by the separate construction of sections which will themselves pay as they go; then when ultimately connected they will give, if not the shortest, at least a continuous and paying system between North and South America. Since Colombia presents perhaps the greatest obstacles to railroad construction of any of the South American republics, any line which proposes to cross any part of its territory should be studied with a view to its possible incorporation in a system that would get us over the ground, somehow, at first, with the least likelihood of proposing a scheme too great to be undertaken at once and upon which, to say the least of it, there is much difference of opinion as to its possibility at all on financial grounds. The Cucuta railroad is, in my opinion, very tempting from the certainty of enormous traffic, but difficult of accomplishment and likely to be expensive. It deserves a far more careful survey and study than I have been able to give it in consequence of the universal ignorance of the conditions I had to meet with when I went over the ground. I spoiled and lost everything I had with me, clothes, instruments, watch, etc., and came nearer losing my life a dozen times in a dozen different ways than I want to do again. But the results of my trip are, I think, worthy of consideration from those who hope some day to be able to visit South America without changing cars from New York or crossing the ocean.

The town of Cucuta, or San Jose de Cucuta, with 15,000 inhabitants, situated in the State of Santander, near the Venezuelan border, is in many respects unique as a commercial center in Columbia. It receives the products not alone of a large extent of territory in Colom-

bia as far south as Pamplona and San Pedro, but also of the important section of Venezuela known as El Tachira, being the only outlet, by means of its railroad, to the Zulia River at Puerto Villamizar (Puerto de los Cachos), thence by steamboats to Maracaibo. Cucuta is also justly celebrated as about the most deadly spot on the face of this earth, and is the only place I have ever visited where the otherwise ubiquitous commercial traveler is never seen. Foreigners of any kind dare not go near it, and *I* certainly should not have gone had I known as much of it as I do now. I entered this section of the country at Puerto Nacional, 300 miles from the mouth of the Magdalena River, took 14 days from there to reach Cucuta, started to come back over the proposed railroad route and barely escaped alive after a month in the forest, failing to get through again to the Magdalena, but thankful enough to get out anyhow to Maracaibo. There have been several lives lost in similar attempts at penetrating that part of the country. Mr. Yepes, an engineer, and his whole corps perished and were never heard of. They starved to death, were murdered by Indians or died of snake bites.

[Mr. Ford then goes on to discuss the traffic prospects of the region. A concession for a railroad was granted in 1887, the concessionaries being interested in cattle shipping, 20,000 head being sold yearly. Considerable money has already been spent, mostly, however, for a wagon road or path to enable cattle to be driven to market more easily than formerly. Some work is still going on, but it amounts to little or nothing. "The workmen scratch a bank here and there, and once in a while build a bridge of palm logs which rots almost as soon as it is completed." The present Cucuta railroad is 55 kilometers long, northward from the city of that name to Puerto Villamizar, and the proposed line would extend from the latter place northwestward to the Magdalena River. The existing road has good earnings and is being constantly improved, most of the bridges being plate girders resting on stone abutments. The track consists of 30 lb. steel rails, and the locomotives, of the Porter plantation type, weigh 14½ to 18 tons. The terminal station at Cucuta is of cut stone and brick, and cost $100,000 in Colombian currency. The desire for a railroad to the Magdalena River has a political significance, the existing rail and water route being so located that all freight either to or from foreign countries has to go through Venezuela. Freight has to pass through endless formalities at three or four custom houses, and Colombian interests constantly suffer. Mr. Ford then describes the physical features of the country through which the proposed railroad would be built, as follows:

The Magdalena Valley is divided from the region tributary to Lake Maracaibo by the main ridge of the Central Cordillera of the Andes, which continues unbroken from south to north until it ends in the low plains of the Goajira peninsula; in getting, therefore, from the Magdalena to Cucuta it is necessary to cross this ridge at some point. The road from Puerto Nacional to Ocaña is so far the crossing farthest north, and is the road always used for cattle, coffee and merchandise. The road where it crosses the ridge I found to be 5,600 ft. above sea level by my aneroid, and after crossing the ridge and dropping to Ocaña at 3,900 ft. it is necessary, in order to get to Cucuta, to cross innumerable other ridges or spurs much higher than the main ridge, which spread out fanlike toward the north, in the valleys between which spring the rivers running into Lake Maracaibo; thus the Catatumbo, which before reaching the lake receives the waters of the Sardinata, Zulia, Pamplonita, Tara, Rio de Oro, etc., takes its rise near Ocaña.

All the above mentioned spurs which I crossed at elevations of from 5,000 to 11,000 ft. above sea level terminate in flat, swampy lands near the boundary line between Colombia and Venezuela, the Rio de Oro being the line in that section and the last of the rivers of any importance flowing into the Catatumbo on its left bank. The problem is therefore a somewhat difficult one, *i. e.*, starting from Cucuta to creep around the foothills of the spurs, cross the rivers in succession, including the Catatumbo where practicable, and yet avoid getting into the land so low as to be subject to serious inundation, to which there is a large proportion liable. In other words, to run a contour line round the spurs until the main ridge of the Cordillera is reached so as to avoid crossing all the divides at higher points. This must either be tunneled or crossed with a section of rack-work line to reach the Magdalena Valley, and forms really the "crux" of the whole scheme, though the balance of it is not extremely simple either. A very crooked line it must be and a very expensive one.

In crossing this section of country we go over in each case a short stretch of flat bottom on either bank of stream, then a low divide of not more than 100 ft. elevation, and literally hundreds of small canos or creeks from 10 to 30 ft. wide, with banks from 5 to 20 ft. high, and with a secondary series of small divides between each, making the most terribly uneven ground to go over that can possibly be imagined. No rock is to be seen anywhere and whenever a flat stretch occurs for half a mile or so it is literally embroidered with pits called tatucos, formed by the falling of large trees and rotting out of their roots, leaving holes in the clay some 6 or 8 ft. wide and 3 or 4 ft. deep, half full of water and mud, and which at first, when my mule was fresh, I found quite amusing to leap over, but which after the first day became far more exciting than pleasant when it got to be a toss up whether I or the mule should be on top when we both found ourselves at the bottom of the pit.

I have no doubt, however, that much of this "corrugated" country can be avoided by keeping farther down, *i. e.*, more to the north, and so reducing the number of river crossings, as nearly all these rivers and caños come together, more or less, and enter the Sardinata at different points before it reaches the Catatumbo.

As the whole region from Tamalameque to Puerto Villamizar is absolutely uninhabited, labor will be an expensive item, and supervision more so on account of the fevers, but rights of way would cost nothing. Transportation of material would also be very costly, though the work could be reached at several points up the various rivers. The bridging would be a very heavy item, at least six important streams having to be bridged which might aggregate half a million dollars alone, and the tunnel or rackwork section, which I presume to be necessary under or over the main Cordillera, an unknown quantity.

I give, however, my opinion, with all necessary reservations, of course, as to the line that a survey should take. The Rio de Oro penetrates the Cordillera much further than any other stream running into the Catatumbo; its valley should be followed as far as practicable, and it is most likely (from the general character of those mountains at Ocaña and elsewhere, which I had every opportunity of observing) that a point would be reached where a tunnel of a mile at the utmost would bring you out to the head of an opposing valley or steam running into the Magdalena. The Rio de Oro could then be followed as far as practicable or desirable, the Catatumbo crossed where it is comparatively confined between high banks, and the rest of the line hunted as a contour line, more or less, according to the circumstances, keeping if possible well above high-water mark all the way to Puerto Villamizar. Such a survey would be costly, as it would have to be well organized to avoid serious disasters, but with canoes in the rivers and regular supplies much time could be saved and good work done. The main point worth ascertaining, after what I have managed to gather, is the actual height and character of the Bobali Pass or Cordillera, to decide whether the whole scheme is worth touching at all. I can only regret exceedingly that I was unable to do this, having to save instead my own life and those of my nine peons by coming down the Catatumbo five days on a raft to Lake Maracaibo, after getting within sight of the Bobali and what with fever, alligators and rapids, we had quite an exciting time.

It is perhaps bold on such a reconnaissance as I was able to make to hazard a guess on the probable cost of such a road, but the concession owned by the gentlemen alluded to includes a grant from the Government of $8,000 gold per kilometer. The distance would probably be about 150 kilometers, and, exclusive of such special works as the tunnel and bridges over the Sardinata, Tana Presidente and Catatumbo, I should say that $15,000 gold per kilometer would cover the cost of construction of a narrow gage road. The number of small bridges would, however, in any case be large, and even supposing it should cost, all told, $3,000,000 gold an income of at least $300,000 gold may fairly be counted upon after a little development of local traffic, or 10 per cent. gross at least, which would be really considerably more to the investors, after deducting the amount paid by the Government under the concession.

I seldom like to put my name to such brilliant figures as these on such meagre information without a saving clause, and the contingencies above mentioned, with other possibilities already pointed out, are serious enough to perhaps halve these results and make it only a five per cent. (gross) investment, if possible at all. I merely report as far as I am able at present to judge. My experience has sometimes been that contingencies have cost more than the regular items in an estimate, so with this warning I dedicate my adventures to the well-wishers of the Intercontinental Railroad as a possible and very favorable link in their line of the future.

TECHNICAL.

Manufacturing and Business.

The Acme Steel Mfg. Co., of Reading, with a capital of $40,000, was chartered at Harrisburg, Pa., on Feb. 12.

The R. P. Wheaton Bridge Co., whose main office is at Chicago, has filed a charter at Lansing, Mich., to do business in that state.

The Bucyrus Steam Shovel & Dredge Company, South Milwaukee, Wis., recently sold two steam shovels to the Heidenreich Company, of Chicago, for use on the Chicago drainage canal now building.

Col. C. A. Sinclair has been elected President of the Burton Stock Car Co., in place of J. C. Moore, who resigned some time ago. Dividends on the preferred stock have been suspended.

David M. Ripley has been appointed Receiver for the firm of Copeland & Bacon, manufacturers of hoisting machinery, at 85 Liberty street, New York, in proceedings to dissolve the partnership.

The Campbell & Zell Co., Baltimore, Md., are increasing the output of their plant, and will purchase new or second-hand planers, lathes, drills, bolt cutters, boring mill, plate planer, punches, rolls, etc.

The McLewee automatic safety water gage, which is manufactured by F. McLewee & Son, of 25 Waverley place, New York, is to be used on the locomotives on the Macon & Northern Railroad in Georgia.

The National Switch & Signal Co., of Easton, Pa., has a contract from the Metropolitan West Side Elevated of Chicago for machines containing 120 levers, and for a number of automatic signals and torpedo machines.

The Carnegie Steel Company, Limited, has purchased from the Industrial Works, of Bay City, Mich., a locomotive crane for use at its Edgar Thompson Steel Works, at Braddock. This is the third crane of this kind purchased by the Carnegie company from the Industrial Works.

The American continuous drawbar has been specified for the following new rolling stock: 1,000 cars for Louisville, New Albany & Chicago; 500 for the Lake Erie & Western; 800 for the Baltimore & Ohio Southwestern; 1,200 for the Baltimore & Ohio, and 1,000 for the Choctaw Coal & Railway Co.

The stockholders of the Niles Tool Works Co., of Hamilton, Ohio, have elected the following directors: Matthew Addy, W. P. Anderson, T. T. Gaff, Alexander Gordon, W. E. Hall, R. C. McKinney, James D. Parker, George T. Reiss and Frank J. Jones. The annual report showed net earnings for the year of $220,000, and a surplus fund of $150,000.

The Sanders hoisting and conveying machine will be used in the construction of a large sewer in Cleveland. The material that will be removed will be elevated by the machine and deposited by it about 300 ft. from the trench. The bucket will return to the trench loaded with brick or mortar. This machine is sold by the Cleveland Engineering Co.

The Alexander Car Replacer Manufacturing Co., of Scranton, Pa., with a capital stock of $100,000, has been organized with these officers: Joseph A. Jermyn, President; John T. Richards, Treasurer; James Russ, Secretary; Joseph A. Jermyn, John A. Meers, John T. Richards, R. B. Williams, G. P. Rodgers, James Alexander and James Russ, Directors.

At the annual meeting of the Bushnell Manufacturing Co., in Easton, Pa., Feb. 5, these officers were elected: E. L. Bushnell, President; E. M. Bushnell, Secretary and Treasurer; E. L. Bushnell, Poughkeepsie, N. Y.; E. M. Bushnell, Easton; H. S. Cavanaugh, Easton, Directors. It was decided to increase the capital stock from $50,000 to $100,000 and to increase the capacity of the plant.

The American Copper & Brass Works, of Cincinnati, O., have just secured the contract for the copper work in the large Anti-Trust distillery, about to be erected in Terre Haute, Ind. Randolph & Clowes, of Waterbury, Conn., will furnish all the sheet copper and seamless drawn tubes used in the work. This is claimed to be the largest single contract for this class of work that has ever been placed.

It seems to be pretty certain that the Lobdell Car Wheel Co., of Wilmington, Del., will have works in North Carolina, although it is not yet decided to build new shops. The Car Wheel Company has purchased an interest in the stock of the North Carolina Car Co., of Raleigh, N. C. That company's plant will be enlarged to include the manufacture of car wheels and also to manufacture axles and other castings under an arrangement of the Johnson company, of Virginia, and has also purchased an interest in the car company's stock.

A. E. Filley, manufacturer of improved asphalt slag products, 29 Broadway, New York, has issued a pamphlet describing the different brands of roofing paints, cement, etc., manufactured by him. It also contains a brief technical treatise on asphalt and slag, together with all notes concerning the manufacture of asphalt roofing and paints, and directions for their use. Mr. Filley also manufactures a special brand of asphalt slag roofing for cars, which is also fully described in the pamphlet referred to.

A charter was granted last week to the Harrison Telephone Co., of West Virginia, with headquarters at Davis, W. Va. The incorporators include Stephen B. Elkins and Henry G. Davis, of Elkins, W. Va.; F. S. Landstreet, of Davis, W. Va.; E. J. Fredlock, of Piedmont, W. Va., and Hon. R. C. Kerens, of St. Louis, Mo. The company will engage in a general telephone business, and will connect the towns along the West Virginia Central & Pittsburgh Railroad, in which the incorporators are all interested. The Harrison telephone will be used.

New Stations and Shops.

The Berlin Iron Bridge Company is building for the Grosvenor-Dale Company, at Grosvenor-Dale, Conn., large iron coal sheds arranged for unloading the coal direct from the cars into the pockets without a second handling.

The Barney & Smith Car Company is making some important improvements at its shops at Dayton, O., which, when completed, will considerably enlarge both the freight and passenger car building capacity of the works. One of the new buildings, 200 × 800 ft., is already completed.

The report that the Lamokin Car Works, whose plant is now in Chester, Pa., will remove from that town and build larger shops at some other points in Pennsylvania has aroused several ambitious towns who hope to secure the new works, among these being Williamsport and Bellefontaine, the latter of which has subscribed about $5,000 to secure the new plant.

The Westinghouse Electric & Mfg. Co. has just let the contracts for the erection of its new plant at Brinton station, near Pittsburgh, to occupy a space of 23 acres. Work has been started on the machine shop, to be 235 × 755 ft., and the warehouse 75 × 755 ft. The Shiffler Bridge Co. and the Keystone Bridge Co. will do all the iron and steel structural work. All the buildings will be two stories in height, and will be fireproof, built of stone, brick and steel.

Iron and Steel.

Work in the steel blooming and billet mills of the Cambria Iron Works at Johnstown, Pa., was resumed on Feb. 12.

The Birmingham Rolling Mills resumed work on Feb. 12 after an idleness of several months. About 900 men will be employed.

The Safe Deposit & Trust Co., of Pittsburgh, has purchased the Columbia Iron & Steel plant at Uniontown, Pa., subject to $120,000 of first mortgage bonds and $1,200 of a mechanic's lien.

Blast Furnace Capacity on Feb. 1.

According to the returns of the *American Manufacturer* the capacity of the furnaces in blast on the first of this month was 108,321 tons. This is a slight improvement on the returns from Jan. 1, and the average capacity for this year has been 105,660 tons, as against an average capacity for the last four months of 1893 of

85,885 gross tons. This is an increase of about 23 per cent. in our production as compared with the last third of 1893. We are not, however, consuming all of our small production, which was only 2,561,584 gross tons for the last half-year. An increase in the unsold stocks of 12,927 tons should be deducted from our make.

The course of our production is shown very clearly in the subjoined table of blast-furnace capacities on the first of each month commencing with January, 1891, which is taken from the *American Manufacturer*:

	1891.	1892.	1893.	1894.
January	163,281	191,442	175,701	102,999
February	139,359	193,007	173,385	108,321
March	120,745	193,827	177,210	.....
April	113,316	188,109	182,169	.....
May	116 586	175,343	186,982	.....
June	147,799	172,890	177,407	.....
July	167,424	169,850	160 952	.....
August	174,502	158,581	115,926	.....
September	174,506	156,194	83,481	.....
October	181 818	161 558	77 334	.....
November	192 743	173,925	84,635	..
December	193,009	175,111	98,089	.....
Total production	8,279,870	9 157,000	7,124,502	.....

Attention was called, in the *Railroad Gazette* of Jan. 26, to the fact that we have been producing and consuming pig iron at the rate of 310 lbs. per capita, but for the last half of 1893 the consumption was at the rate of only about 170 lbs. per capita. A considerable portion of the iron not marketed and consumed will not be called for. It is, however, improbable that we shall permanently reduce our consumption to 55 per cent. of what, in view of our requirements since 1889, may be called our normal consumption. Just at present all the materials of production and consumption average lower in price than ever before; labor is probably cheaper than since the winter of 1877-78, and there is a plethora of money. These considerations seem to be reproducing, to some extent, the confidence in the future which led to our large production in the past. The mild steel trade seems to be the first to show signs of a revival, and it is to be hoped that other branches will soon follow.

The New Orleans Bridge.

The proposition of the Phœnix Bridge Company to construct the Mississippi River Bridge at New Orleans has been accepted. Full detailed information of the structure is not yet given to the public. The work contemplates a doubletrack metal superstructure about two miles in length. The approaches will consist of spans varying from 25 to 150 ft., as the heights of the towers increase. The river portion of the bridge will be a cantilever structure with a central span of 1,070 ft. and anchor spans of 608 ft. The title of the company is The Southern Bridge & Railway Co., of which Mr. E. L. Corthell, C. E., of Chicago, is President.

Car Coupler Tests.

In some pulling tests of drawbars and knuckles recently made by the Fairbanks Company, of New York, one knuckle broke at 157,400 lbs., which exceeds the record of any test of car couplers heretofore made on the Fairbanks testing machine. The drawbars in this test were uninjured and they had been selected promiscuously from a lot of 1,000 of the regular manufactured bars. The report contains other tests equally interesting, among others a pair of drawbars which were subjected to 40 tests averaging 124,120 lbs. These bars were of malleable iron with steel knuckles and pins and were furnished by the Smillie Coupler & Manufacturing Company.

Red Lead on Ironwork.

There has been a very general impression that red-lead paint was the best preservative for iron, though red lead is a highly oxidizing substance and theoretically should not be as good a preservative as many other paints. Mr. W. Thomson, in a paper read before the Manchester Association of Engineers, states that he finds that red lead has the effect of producing a skin of the unoxidizable black or magnetic on the iron itself, thus protecting it against further oxidation. Further experiments showed that other oxidizing agents, such as manganese dioxide, form a paint which also protect structura lron from rustiing.

A Large Concrete Arch Bridge.

From an article in the *Deutsche Bauzeitung* we take the following notes on a large arch of Portland cement concrete recently built, which spans the Danube at Munderkingen, Wurtemberg. The arch has a span of 164 ft. and a rise of 1 in 10. It is the largest concrete arch in Germany, and by its small rise gives evidence o a boldness of construction which surpasses other con crete bridges, among which we mention the Isere Bridge, span 85 ft., and rise 1 in 10; the Erbach Bridge, span 105 ft. and rise 1 in 8; and the Murgthal Bridge, span 131 ft. and rise 1 in 10. The width of the arch is 24¼ ft., and the distance between railings is 26¼ ft. One abutment consists of limestone, whereas the other is formed of 145 piles, driven into the ground obliquely. The span between the extrados of the arch and the roadway has not been filled in, so as to keep the dead load light. As pressure for the arch has been admitted 426 lbs. per square inch. At the skewbacks and at the apex, arch joints have been arranged to take up the effect of the settling. The arch settled 2 13/16 in. when the centers were removed and 1⅛ in. more after the full weight of the roadbed, amounting to about 165,000 lbs., had been put on, the abutments yielding ⅛ in. laterally. The architectural forms of the bridge have been built in red cement. The cost of the bridge was $21,500.

The Metric System.

At the December meeting of the Engineers' Society of Western Pennsylvania a resolution was adopted that in papers read before the Society all dimensions and quantities shall be expressed in terms of the metric system. The resolution was introduced at the November meeting by Mr. George H. Paine, and after long discussion was laid over to the December meeting, when it passed with little opposition. A number of members volunteered to make the conversions in the papers of those members who prefer to use the English units in writing. It is the hope of the members who procured this action that similar action will be taken in other societies.

Test for Steel.

The *Mechanical News* describes a simple test to distinguish iron from steel by pouring on the metal to be tested a drop of nitric acid, and, after letting it act for one minute, rinsing with water. On iron the acid will cause a grayish white stain, while on steel the spot will be black.

Pintsch Light on the Illinois Central.

The Illinois Central has decided to replace the oil lamps now in use on its Chicago suburban trains by the Pintsch system of gas lighting. The vestibuled limited trains have been lighted by gas for some time, and now, after a series of experiments to determine the number of lights necessary, the suburban cars will be equipped with four lights each. This will be done as quickly as possible, one train at a time being taken off of the road and equipped.

Aluminum.

The *Ohio Valley Manufacturer* predicts that aluminum will be sold this year in Europe at 45 cents a pound. About a year ago it declined to 50 cents, but subsequently rose to 75 cents a pound. The *Manufacturer* prophesies that aluminum will be produced in enormous quantities and at prices which will permit many new uses. The manufactory at Newhausen, Switzerland, has increased its dynamo capacity to 4,000 H. P., and made improvements in the processes so that it proposes to make the price 45 cents a pound or lower. At this figure the price of aluminum will be cheaper than that of copper, if the bulks and not the weights be considered, owing to the lower specific gravity of aluminum. It is and has been cheaper than tin of the same bulk for some time.

Some specimens of aluminum bars manufactured by the Pittsburgh Reduction Company have been received which gave interesting results from tests. One is a sample aluminam angle 1 × 1 + ⅛ in., also some hard samples of metal which in rolled sheets have stood a tensile strength of between 50,000 and 60,000 lbs. per square inch and over 35,000 lbs. per square inch elastic limit. This metal has also stood a drifting out equal to soft steel.

Switch Light Practice in Chicago.

The Division Superintendent of one of the Chicago roads has lately investigated the practice of his neighbors in the matter of colors for ordinary switch lights and he has made up the following lists, showing the present practice:

List A.—Names of roads using red for the switch track and white for the running track on *all* switches: Atchison, Topeka & Santa Fe, Chicago, Rock Island & Pacific; Chicago & Alton; Chicago Great Western; Chicago & Grand Trunk; Chicago & Erie; Chicago, Burlington & Quincy; New York, Chicago & St. Louis.

List B.—Names of roads using red for the switch track and green for the running track on *all* switches: Baltimore & Ohio; Chicago & Northern Pacific; Chicago & Calumet Terminal; Chicago & Western Illinois; Belt; Chicago & Northwestern.

List C.—Names of roads using red for switch tracks and white for the running track on all switches leading off the *main line*, but using red for switch tracks and green for the running track *only* in yard switches: Lake Shore & Michigan Southern; Chicago, Milwaukee & St. Paul; Pittsburgh, Cincinnati, Chicago & St. Louis.

List D.—Names of roads using red for switch tracks and white for the running track on all switches leading off the *main line*, but using green for switch tracks and white for the running track *only* in yard switches: Wabash; Michigan Central; Illinois Central; Pittsburgh, Fort Wayne & Chicago.

It appears that one of the roads in group A contemplates adopting the practice shown in group B, while the latter is the personal preference of still other superintendents. This is a hopeful indication, as there is little doubt that the use of white for switch and signal lights is an element of danger, and one which increases with the increase of large yards and of railroad tracks in large towns. While the conflicting interests in this problem are often very hard to adjust, and while a switch light or a signal which has to be left unattended in one position for hours or days at a time must always be somewhat inconsistent with the best semaphore practice, anything which tends to abolish or restrict the use of white as a "color" is pretty sure to be in the line of progress.

THE SCRAP HEAP.

Notes.

A train of the Virginia & Truckee was robbed of a box containing $1,000 on the night of Feb. 10.

A press dispatch reports the "Pennsylvania Company's vaccinaton train" on the road between Lima, O., and Chicago.

The newspapers report serious "financial irregularities" among passenger conductors of the New York, New Haven & Hartford.

It appears that the Philadelphia & Reading and the Central of New Jersey have adopted the standard code of train rules, as well as the Lehigh Valley.

Michael Donohue, the switchman who was in attendance when the passenger train on the West Shore road was derailed at Newburgh last July, has been imprisoned for one year.

The Pennsylvania Railroad has issued annual passes to all conductors and enginemen who have served in their present capacities for ten or more years. According to a Pittsburgh paper, these passes are good for the holder and his wife.

It is doubtful whether the Pennsylvania Railroad will exhibit at Antwerp next summer. At appears that the managers of the Exposition there demand a fee of $18 a square yard for space, which would tax the Pennsylvania about $10,000.

Three ex-members of the Brotherhood of Locomotive Engineers in New York City have applied to the Supreme Court for an injunction against the life insurance feature of the Brotherhood. They say that this feature is compulsory and they claim the right to belong to the association without being insured.

The coroner's jury, at Hoboken, N. J., has rendered a verdict on the collision of Jan. 15 on the Delaware, Lackawanna & Western, holding that the flagman of the foremost train neglected his duty in not going back promptly when his train slackened speed. The railroad company was censured for not having a proper signal system.

It is reported that the Receivers of the Northern Pacific have reached an amicable agreement with the employees who have been complaining at the reduction of pay which went into effect Jan. 1. The concessions made by the Receivers seem to be chiefly in the matter of regulations and not in rates. The six principal brotherhood chiefs were in consultation with the Receivers for a long time.

The Southern Pacific road will exhibit at the California Mid-Winter Fair the locomotive "C. P. Huntington," one of the first engines run in California, alongside of a new compound locomotive No. 1999. The latter has four pairs of drivers with a four-wheel front truck, while the "Huntington" has but one pair of drivers. There will also be exhibited freight car No. 1, along with a new furniture car, which by its bulk and its high number (69,066) will serve to illustrate the contrast between the early days and the present. There will also be an old and a new passenger car.

Retrenchment has by no means come to an end on the railroads. The New York Central has discharged a good many men during the past 10 days, and, according to the Buffalo papers, will take off about 10 passenger trains running trips of from 30 to 100 miles. The South Side Elevated Railroad in Chicago has reduced the pay of conductors and brakemen, having reduced stationmen before. A dispatch from Indianapolis reports that the Cleveland, Cincinnati, Chicago & St. Lonis will make further important reductions of forces. The Central of New Jersey shops at Elizabeth have been ordered to run only 45 hours a week. Several small roads have reduced wages 10 per cent.

The Massachusetts Legislature is now striving every week in a truly creditable manner to emulate the most enterprising legislatures of the West. The Railroad Committee of the House has reported a bill forbidding railroads to make a change in time-tables without the consent of the Railroad Commissioners. Another bill ha been reported to establish the office of Railroad Inspector. This seems to have been offered by some member without consultation with the Railroad Commissisners. A bill has also been introduced to establish a board of telephone and telegraph commissioners. The New York Legislature has before it a bill to prohibit the use of free passes by legislators and state officers. One of the provisions is that members living 125 miles or more from Albany shall be allowed mileage twice a month. In Ohio a bill has been introduced requiring railroads to pay into the state treasury all unclaimed freight charges. This, we are sure, will enrich the state to a fabulous amount.

Lake Tonnage.

The United States Treasury Department reports give the number of vessels on the lakes as 3,657 with 1,183,583 gross tons register. Of these 321 vessels are steamers of over 1,000 tons, aggregating a register of 534,490 gross tons. The classification of the entire lake fleet is as follows:

Class.	Number.	Gross tonnage.
Steam vessels	1,631	763,063.32
Sailing vessels	1,226	319 617.61
Canal boats	731	75,580.50
Barges	69	25,321.12
Total	3,657	1,183,582.55

The tonnage built on the lakes during the five years ending with 1892 was 473,724 net tons.

The Missabe Iron Mining Companies.

At the annual meetings of the several iron companies going to make up the Lake Superior Consolidated Iron Mines, and of the Duluth, Missabe & Northern road, the control by the John D. Rockefeller interests

was plainly manifest. The Merritt, of Duluth, who was in control, have been forced to become minority stockholders, though under conditions which may possibly give them control later. Four of the mining companies, the Mountain Lion, Bimabik, Shaw and Great Northern, elected W. J. Olcott President and General Manager, while Alex. McDougall, E. H. Hall, N. B. Merritt and J. B. Cotton, all of Duluth, were elected respectively Vice President, Secretary, Treasurer and Attorney. In the directorates the Rockefeller ascendency is pronounced. The mines will be concentrated and worked as the market demands, at less expense than under the old system.

A New Way of Abusing the Public.

EDITOR REPUBLICAN—Sir: I was a passenger on the train which arrived here at noon to-day, on which there were several carloads of passengers, and among them several Eastern people. As the train was pulling into the yard here a leather-lunged brakeman passed through the cars shouting, "Look out for your overcoats and grips; we are pulling into Fresno." Whether he was obeying instructions from headquarters or was indulging in a dreary attempt to be facetious I do not know. . . . Fresno has enough to contend with so far as the Southern Pacific is concerned without gratuitous flings of this character. . . . H.
—*Fresno (Cal.) Republican.*

The Coal Resources of Ohio.

Professor Orton, the state geologist of Ohio, in a lecture before the Ohio Institute of Mining Engineers, stated, in part, that the coal area of Ohio is about 10,000 square miles. Out of some 45 veins of coal in the state 12 or 13 were good for mining almost anywhere on their course. About 20 veins could only be mined here and there, mentioning the Kittanning, Freeport, Pittsburgh and Meigs Creek veins, with 8,893 square miles of area and 41,478,000,000 tons, the Professor said that with an allowance of 40 per cent. for mistaken judgment and loss in mining, 25,000,000,000 tons would be left, as available coal in Ohio. The annual product is about 14,000,000 tons, and the demand is increasing at present at the rate of 6 per cent. yearly. From his data he estimates a continuance of the supply of this coal through 700 years.

Manchester Ship Canal.

A Manchester accident insurance company has issued a pamphlet in which it states that the number killed on the canal during the last five years was 154; the number permanently disabled was 186, and the number partially injured was 1,404: total, 1,744. Most of the fatal accidents occurred on the railroad tracks. Another cause was falls of scaffolds and bridges.

At the first meeting of the Manchester Association of Engineers for 1894, the Association adopted resolutions congratulating the chairman and directors of the canal on the successful opening, and in that connection it took occasion to recognize with much satisfaction the invaluable services rendered in the achievement of so great a triumph, by several of their own esteemed members, notably the late Daniel Adamson, and Messrs. Richard Peacock, the present Mayor of Salford, Alderman Bailey, C. J. Galloway, and the Engineer-in-Chief, E. Leader Williams.

Chesapeake & Ohio Canal.

The capital stock of the Chesapeake & Ohio Canal Co. is $3,851,593, of which the United States owns $1,000,000 and the state of Maryland the greater part of the remainder. The state also holds mortgages, one for $4,375,000 and another for $2,000,000. These sums were insufficient to complete the canal to Cumberland, and the incomplete canal was comparatively valueless and without earning capacity. In 1844 the legislature passed a law authorizing the company to borrow $1,700,000 to complete the canal, and bonds to the amount of $1,699,600 were issued under it in 1848. The canal is now operated by the trustees of these bonds under the decree of the court made in October, 1890. Under that decree the trustees have until May 1, 1895, to show whether or not the canal can earn a sufficient revenue to justify its continuance as a waterway. The trustees of the bondholders are required to make reports of their receipts and disbursements, and a statement of the work at stated times. The present physical condition of the work is said to be better than it has been at any time since its construction.

About 200 boats are running, and the amount of coal transported in 1893 was about 340,000 tons. At a toll of 30 cents this would produce $102,000. A considerable revenue is also derived from water-power rentals. In 1888, the year before the freshet, the tonnage of the canal was 155,216. The business for 1893 was greater than for any year since 1880, when it was 471,800 tons. The largest amount of coal carried in any one year was 715,673 tons, in 1875. The capacity of the canal is limited by the tunnel. This is seven-eighths of a mile long and boats cannot pass each other in it, and it is likely that not more than 1,000,000 tons of coal can be passed through it in a season.—*Coal Trade Journal.*

A Ferris Wheel "Invented" in England.

The great revolving wheel which is to be erected at Earl's Court of 300 ft. in diameter, is now stated to be the invention of the "Gigantic Wheel and Recreation Towers Company, Limited," and no one else will have any interest or property in it, except that the District Railway Company will receive as rent a part of the receipts.—*Railway News* (London).

Lakes St. Clair & Erie Ship Canal.

The Lakes St. Clair & Erie Ship Canal Co. has been organized at West Superior, and will establish headquarters at Milwaukee, it is said. The capital stock is placed at $250,000. The stockholders include some of the most prominent men at the head of the lake, also capitalists of Minneapolis, St. Paul, Chicago and Eastern people. D. F. Henry, of Detroit, is Chief Engineer of the company, and W. C. Porter, of Minneapolis, is Treasurer.

This is the company that proposes to make a cut-off canal that will shorten the distance between the upper lake ports and Buffalo by about 100 miles.

A Standard Meter Gage for Spanish Railroads.

At the instance of Don Juan Isla, Concessionaire of the Turis to Madrid Railroad, a meeting of the managers of the meter gage railroads of Spain was held at Madrid on Jan. 22, for the purpose of memorializing the Cortes on the advisability of adopting the meter gage as a standard. It was pointed out that this gage is used on 1,000 kilometers of road in Spain; that 2,000 kilometers of meter gage railroad are in process of construction; and that concessions have been granted for an additional 3,000 kilometers. The gages at present used in Spain are 5 ft. 6 in., 1 meter, and 75 centimeters (=2.46 ft.), the broad gage having been considered the standard. Señor Isla reviewed the disadvantages of the broad and narrow gages, and emphasized the necessity of uniformity to promote the free movement of traffic, and urged that all future concessions should specify adherence to meter gage, and that other roads should by degrees be brought into conformity with this standard. The matter was laid before Señor Moret, the Minister of Fomento, who promised to recommend the plan to the favorable consideration of the Cortes.

Wrecking Under Difficulties.

A 60-ton engine of the Canadian Pacific recently ran off the track on an embankment in New Brunswick and fell into Harvey Lake, being submerged in 30 ft. of water and mud; and the St. John *Globe* tells how Master Mechanic Haggerty got it back upon the track. The winter has been severe in New Brunswick, and much of the time the thermometer has stood at 30 deg. below zero, the usual accompaniment of wind blowing at 50 miles an hour being generally present. It was at first necessary to spend two days in getting out the body of the fireman who was drowned and in getting a snowplow upon the track. Then, after suspending work for days in succession on account of the severe cold, preparations were finally completed for raising the engine. In the rock upon the hillside, about 100 ft. above the track, 3-in. holes were drilled about 20 in. deep, and in these were placed steel posts for fastening guy lines. The men who did this work were kept from freezing by fires kindled upon the ground, which first had to be cleared of 4 ft. of snow. Anchorages were also secured by laying deadmen alongside of the track, which being well tamped with wet gravel, were soon frozen so solid that they were as strong as the iron fastenings. Sheers about 30 ft. long were set up. It was impracticable to employ a diver, and the work had to be carried on without delaying trains. A swinging mirror attached to a long pole was used to give light at night to enable cables to be fastened to the wreck, the highest point of which was about 15 ft. under water. The driving wheels had sunk among boulders, so that a lifting force of about 240 tons had to be exerted to start the engine. Three locomotives were employed to pull together on the falls. The most serious drawback was the breakage of three 3-in steel hooks, which allowed the engine to fall 9 ft. Hooks were then made of car axles, and the engine successfully raised to a temporary track.

Standard Time in Europe.

The railroads of Switzerland have agreed to adopt standard time on June 1. When this change takes effect all the railroads of Europe originally scheduled to adopt central European time will have done so with the exception of Denmark and Norway. If the French railways could be induced to follow the example of those of Holland and Belgium and adopt Western European (Greenwich) time, the lines in Spain and Portugal would doubtless also conform, and the system be practically completed. The German railways connect with those of Denmark at two points only. Between Sweden and Norway there are but three railway junctions, while between France and Spain there are but two. Should the French railways take the action suggested, the differences of odd minutes between railway standards would no longer exist in any of the Western portion of Europe except at the seven points above mentioned, and at half a dozen points between Spain and Portugal. St. Petersburg time, by which the railways in the Western part of Russia are generally governed, is but one minute faster than Eastern European time, the latter being now used by the railways of Bulgaria, Roumania and Eastern Turkey. The Grecian railways, which do not connect with any other lines, use Athens time.—*Official Guide.*

LOCOMOTIVE BUILDING.

The Baldwin Locomotive Works last week shipped five compound locomotives for the Government Railroads of New Zealand.

CAR BUILDING.

The Litchfield Car & Machine Works are building 100 ore cars for the Duluth, Mississippi River & Northern.

The Indiana Car & Foundry Co., at Indianapolis, is now working on a contract to build 250 refrigerator cars.

The Madison Car Works, at Madison, Ill., will resume work probably this week, after being closed for nearly eight months. It is expected that 400 men will be employed at once. The directors propose to issue $200,000 of preferred stock, of which $60,000 will be accepted by the creditors for part of their claims, and the balance of stock will be offered for subscription.

The recent equipment contracts of the Electric Traction Co., previously referred to, were for 80 cars. The contracts were awarded as follows: 39 to the Pullman Palace Car Co., Chicago; 30 to the American Car Co., of St. Louis, and 10 to J. G. Brill Co., Philadelphia. All of the above will use the General Electric Co.'s motor. Ten cars were awarded to the Jackson & Sharp Co., Wilmington, Del., on which the Curtis motor will be used.

BRIDGE BUILDING.

Drayton, Ont.—J. S. Adams, Reeve of this town, invites tenders for the erection of a bridge over the Connestoga River at Main street. Tenders are asked for an iron structure, contractors to furnish their own plans.

Dorchester County, Md.—A bill introduced in the Maryland Legislature last week to authorize the County Commissioners of Caroline and Dorchester counties to build a free bridge over the Linchester River has passed the House.

Ferguson, Ont.—A new bridge is to be built here. Particulars may be obtained from the town clerk of Wallace, Ont.

Listowell, Ont.—The Roads Committee of the County Council have recommended that a new bridge be built at the boundary line between Perth and Oxford.

Lockbourne, O.—Proposals opened for the construction of the Commerce street bridge over the canal at Lockbourne, this county, were as follows: Samuel H. Martin, from $1,000 to $1,350; King Bridge Co., Cleveland, $1,042; F. P. Hampshire & Co., $1,300; Wrought Iron Bridge Co., Canton, $999 to $1,599; Columbus Bridge Co., $985 to $1,375; Mt. Vernon Bridge Co., $1,165 to $1,275; Variety Iron Works Co., Columbus, $1,041 to $1,619; Bradbury & Spencer, $867; Nashville Bridge Co., $1,000 to $1,425; Toledo Bridge Co., $990 to $1,225; Brackett Bridge Co., $995 to $1,635; Pittsburgh Bridge Co., $1 300 to $1,500; G. W. Knoff, $1,250; Penn Bridge Co., $1,440 to $1,700; Champion Bridge Co., $1,150 to $1,250; Canton Bridge Co., $1,425; Youngstown Bridge Co., $1,125; Groton Bridge & Mfg. Co. $1,435 to $1,448; Detroit Bridge & Iron Works Co., $1,300 to $1,600. The structure is to be 76 ft. long, with an 18-ft. roadway.

London, Ont.—Plans are to be prepared at once and tenders invited for building a bridge at Kilworth, in accordance with a resolution passed by the County Council.

The question of rebuilding the bridge over the Grand River between West Garafraxa and Fergus will also be decided soon.

Mattawa, Ont.—The Dominion Government has given its approval of the construction of a railroad bridge across the Ottawa River at Mattawa, by the Temiscamirgue Colonization Railway Co.

Millvale, O.—The contract for a small bridge at this place was let on Feb 6, to the Wrought Iron Bridge Company, of Canton, O. The bridge is to be 50 ft. long and 36 ft. wide.

Osgoode, Ont.—A contract for constructing a bridge over Gray's Creek in the township of Osgoode has been awarded to Bruce & McVey, Ottawa. The amount of the contract is $5,250.

Ottawa, Ont.—A joint committee from the councils of Hull and Gatineau Point has interviewed the Minister of Public Works relative to the construction of the Pond Creek bridge. Tenders will be called in a few weeks.

Pittsburgh, Pa.—In his annual report Superintendent Paisely, of the Bureau of Highways, recommends 20 city bridges for repairs.

A committee of the City Council has favorably recommended the ordinance for the construction of a bridge across the Monongahela River, from Forbes and Brady streets to Twenty-second street.

The Pittsburgh Bridge Co. has received a contract for a steel viaduct 315 ft. in length, from the Schenley Park & Highlands Electric Ry. Co. The same company has an order from the Allegheny Valley Ry. Co. for a 60-ft. deck-plate girder span.

Red Wing, Minn.—The proposition to issue $70,000 worth of bonds to aid in the construction of a wagon bridge across the Mississippi River was carried by a large majority at the recent election at Red Wing. The principal opposition came from the Duluth, Red Wing & Southern Railroad, which wanted a combination railroad and wagon bridge built.

Renfrew, Ont.—The City Council has granted a sum of $2,000 to the County Council to aid in the construction of a new bridge over the Bonnechere River.

Sarnia, Ont.—The Railway Committee of the Dominion Government is now considering the question of permitting the construction of a bridge over the Grand Trunk Tunnel Cut at Sarnia.

Sharpstown, Md.—A bill has been introduced in the Maryland Legislature to authorize the county commissioners of Wicomico and Dorchester counties to build a bridge over the Nanticoke River at this place.

St. Louis.—A bill has been introduced in Congress to authorize the construction of a new bridge across the Mississippi River at St. Louis. The bridge is to be built by the East St. Louis & St. Louis Bridge & Construction Company.

Tacoma, Wash.—The bids for the Eleventh street bridge across the Puyallup River channel were opened last week by the Board of Public Works. Only seven of the 11 bids offered were considered by the board. Following are the bids considered: H. Krusi, representing the San Francisco Bridge Co., $91,900; King Bridge Co., $98,914; Pacific Bridge Co., $100,800; Matthews, Krech & Co., $101,073; King Bridge Co., steel girders, $102,414; Hoffman & Bates, $102,500; Bullen Bridge Co., $103,000.

The west approach to the bridge will be 340 ft. in length, and the channel span will be 620 ft. The east approach will be a pile trestle about 1,000 ft. in length. The St. Paul & Tacoma Lumber Co. has agreed to build this trestle at a cost not to exceed $5,000.

Wellington, Ont.—A 14-foot bridge over the Grand River, between the counties of Wellington and Waterloo, will be erected by the Wellington County Council.

Wheeling, W. Va.—Messrs. Hoge & White, civil engineers of Wheeling, W. Va., have made a careful examination of the Market street bridge over Wheeling Creek, and report to the Board of Public Works that the bridge will have to be replaced within a short time. It is proposed to build a new steel bridge, 50 ft. wide (full width of the street), with sidewalks, pavements and carrying water and gas mains the same as in the main street. It is estimated that the cost of such a structure will be about $90,000. The matter will be presented to the City Council in time for the money needed to be provided for in the annual appropriation ordinance next month. This bridge is to be only one square away from the fine stone arch bridge with 158 ft. span, built within the past three years.

RAILROAD LAW—NOTES OF DECISIONS.

Powers, Liabilities and Regulation of Railroads.

In Alabama the Supreme Court rules that a city ordinance, providing that a railroad shall not obstruct a street by allowing cars to remain on or across the same for a longer period than three minutes, is valid, but an ordinance which prohibits a railroad between the hours of 6 a. m. and 11 p. m. from moving its cars across a street for the purpose of being distributed in the yards, without regard to whether they are stopped on the street or not, is void, because unreasonable.[1]

The Supreme Court of New York rules that an ordinance of the city of Buffalo restraining the speed of trains crossing public streets at grade to six miles an hour, except "passenger trains running on the Belt Line of the N. Y. C. & H. R. Railroad," is not invalid as making an unreasonable discrimination between roads, where it is shown that the Belt Line is not a railroad company, but merely a particular train run around the city for local passenger traffic only, and not competing with any other road.[2]

In Florida it is held by the Supreme Court that contracts requiring a railroad to establish its depot at a particular point are void as against public policy.[3]

The Supreme Court of Alabama holds that in an action against a railroad for breach of a construction contract, an instruction that profits which would certainly have been realized but for defendant's default were recoverable, but not those which were speculative, contingent, probable, or remote, was faulty in use of the word "probable," since profits reasonably probable might be recovered.[4]

It Kansas it is held that under the statutes which require the charter of a railroad company to state the places from and to which the road is intended to be run, the contention that the road must be longitudinal, rather than circular, and extend from one place to another, so as to have at least two termini, is without force; and a circular or terminal railroad may be projected and a company organized for that purpose may exercise the power of eminent domain.[5]

Injuries to Passengers, Employees and Strangers.

In Nebraska the evidence showed that after the train stopped at C., for which place plaintiff held a ticket, the conductor called out the name of the station, but did not leave the train, being engaged in collecting tickets; but by his order the brakeman got off and assisted some passengers to alight, and, seeing no others, cried "All aboard;" that after the train was under way plaintiff left the rear car, which she had occupied, and, without warning to the conductor or brakeman, and without looking to see where she would alight, jumped from the train and was injured; that ample time was given to alight at the station; that plaintiff was a young woman of average intelligence and well acquainted with the premises, The Supreme Court holds that the evidence was insufficient to show the negligent starting of the train without giving plaintiff sufficient or reasonable time to alight.[6]

In the Federal Court it is held that when the conductor by mistake sells a berth reserved for passengers getting on at a certain station, but, a reasonable time before reaching such station, notifies the passenger to whom he has sold it of his error, and tenders another berth equally good, such passenger has no cause of action if she refuses to accept the berth so offered, and voluntarily leaves the car.[7]

In Wisconsin it appears that the plaintiff purchased a ticket over defendant's road from S. to P.; that, on arriving at P., plaintiff decided to go to T., the next station beyond; that there was no ticket office at P.; and that, after the train left P., plaintiff tendered defendant's conductor the amount of the regular fare to S., and on refusing to pay 25 cents additional, was ejected from the car. The Supreme Court holds that such ejection was illegal.[8]

In the same case it is ruled that under the statue providing that if any passenger shall refuse to pay his fare, it shall be lawful for the conductor to put him off at any usual stopping place or near any dwelling house, the ejection of a passenger for non-payment of fare, at a point three-fourths of a mile from any station or dwelling house, is unlawful.[8]

In South Carolina it is held that where a colored person is compelled to leave a depot waiting room provided for white people, in which no chewing or smoking is allowed, and to go into another room, provided for colored persons, in which there is then no chewing or smoking, the accommodations in the two rooms are not unequal because smoking and chewing had been allowed at some other time in the latter room.[9]

In Alabama the Supreme Court rules that where a switch engine attatched to plaintiff's train was being operated within the limits of a city having an ordinance forbidding a greater speed than eight miles an hour, a continued signal by plaintiff to the engineer "to come ahead," or "to come faster," given when the engine was nearing a switch and running five miles an hour, might be considered as a signal to increase the speed so as not to violate the ordinance, or render it impossible to comply with the company's rule that engines should slow up before reaching a switch, but did not warrant an assumption that the signal called for an increase of speed to 15 or 20 miles an hour, so as to render plaintiff guilty of contributory negligence.[10]

In the Federal Court it is held that in an action by a railroad employee for injuries by being run over by defendant's engine, plaintiff is entitled to recover where it is shown that the valves of the engine were leaky, and allowed steam to accumulate in the cylinder, and move the engine in spite of those in charge of it, which defect was known, or should have been known, to defendant.[11]

In New York it is ruled by the Court of Appeals that the fact that a telltale is so near a bridge that a brakeman, facing the rear of the train, after passing under the telltale without being touched thereby, could not see it in time to avoid the injury, is evidence of negligence sufficient to go to the jury, since the statute requires suitable warning signals.[12]

In Texas it is held that a locomotive engineer assumes the risk of an accident caused by a collision between his locomotive and a cow fastened in a railroad bridge.[13]

In Massachusetts the Supreme Court holds that a switchman who is injured by catching his foot between the planking covering the railroad yards is not entitled to recover damages therefor where he had been working in that yard for six weeks, during which time the planking had remained in the same condition.[14]

In Iowa the plaintiff, a conductor on defendant's freight train, was ordered by the trainmaster to hurry and loosen some brakes, and ran to overtake the cars, which were moving at six miles per hour. He climbed up the side of a car and was struck by an awning of an hotel owned by defendant. The only way in which the brakes could be loosend was as attempted by plaintiff, and in his haste he did not see the awning. The Supreme Court holds the railroad liable.[15]

In Minnesota it appeared that plaintiff was employed as a section hand, and was several miles ahead of a train on a handcar which was overtaken. While plaintiff and his foreman were endeavoring to remove the handcar from the track the train collided with it, and plaintiff was injured. The freight train passed at the rate of from 16 to 35 miles an hour; the rules of the company provided that such trains should not pass stations at a speed greater than eight miles an hour. The Supreme Court holds the railroad liable.[16]

In Alabama, in an action against a railroad for personal injuries, the evidence showed that the engineer through whose negligence the accident occurred was under contract not to go into a saloon, or drink whisky, while in defendant's "employ." The Supreme Court decides that he was in such employ during the interval from his arrival at a terminus of the road on one day until his departure therefrom on the next day.[17]

The Court of Appeal of Kentucky rules that for a foreman to move a train backward against a standing car without awaiting a signal from a switchman who is to make the coupling is negligence.[18]

In Indiana it appeared that an engineer in charge of locomotive No. 172 was ordered to sidetrack at a station at night, and wait until locomotive No. 167, in charge of plaintiff, had passed; that on reaching the station, and waiting a few minutes, No. 172 started ahead, and, on seeing No. 167 coming, stopped; that the headlight of No. 172 was defective, and could not be used, but that hand lights which were for use in case of emergency, and which would throw a light for five miles, were on board, but were not used; that plaintiff did not see No. 172 in time to stop his engine, and ran into it and was injured. The Supreme Court holds that the negligence of the engineer in charge of No. 172 was the proximate cause of the accident, and not the failure of the company to provide a proper headlight.[19]

In Texas in an action by a section hand against a railroad company for personal injuries it appeared that the maul with which plaintiff was driving spikes was battered; that the spike he was driving when he received the injury was old and bent, with grease on the head of it; that when he first struck the spike it flew; that though a fellow servant proposed to geta new one, defendant's foreman told plaintiff to strike again, and that, as he struck, the spike again flew up, injuring him in the eye, The Supreme Court holds this evidence sufficient to support a judgment for plaintiff.[20]

The Supreme Court of New York holds that a railroad is not negligent in not requiring lights to be placed on all moving cars in its yards for the protection of employees, since it would require so many men and lanterns and so much time as to be impracticable.[21]

In a case in the Supreme Court of the United States the evidence was that deceased, after leaving a train at a small way station, stopped to help a family, including two small children, to alight from the car, and started towards the station, purposing to spend the night there. In so doing he stepped upon an intervening track, which had been leveled up with earth for crossing, and was struck by a train which was moving rapidly without ringing a bell. The family that deceased had assisted barely escaped, and two members thereof testified that they did not know that they were walking upon a track, and had no idea that a engine was approaching. There was no light, except a bonfire and the locomotive headlights. There was some conflicting testimony as to these facts, but the jury gave a verdict for plaintiffs. The Supreme Court holds that defendant was not entitled to an instruction that deceased was guilty of contributory negligence.[22]

In Mississippi the plaintiff, while crossing a trestle of defendant railroad company, was overtaken and struck by its engine. He was afraid to run back, lest he might meet the coming train on the track, and feared to jump from the trestle, because the ground was covered with water, of whose depth he was ignorant. Moreover, the peril of a leap was augmented by stubs of saplings projecting above the water, and he therefore attempted to reach the other side of the trestle. The Supreme Court rules that it was a question for the jury whether he was negligent after seeing the train and realizing his danger, and that a peremptory charge for defendant was error.[23]

In Kentucky the Court of Appeals rules that one who goes on the main track of a railroad, at a place not a crossing, and where persons are not in the habit of passing, is a trespasser; and the failure of the servants of the company to warn him, by bell or whistle, of the intended movement of a train, is not negligence, where they did not discover him in time to prevent his being run over.[24]

The Supreme Court of New York holds that a violation of a city ordinance requiring a railroad company to close all gates at grade crossings one minute before a locomotive passes does not establish a cause of action against the railroad company for killing of a person at such a crossing, though it is evidence bearing on the question of negligence.[25]

[1] Birmingham v. A. G. S. R. Co., 13 South., Rep., 141
[2] Buffalo v. N. Y., L. E & W. R. Co., 23 N. Y. S., 303.
[3] Florida C. & P. v State, 13 South. Rep., 103.
[4] T. & C R. v. Danforth, 13 South. Rep., 51.
[5] State v. Martin, 33 Pac. Rep., 9.
[6] C., B. & Q. v. Landauer, 54 N. W. Rep., 976.
[7] Mann Boudoir Car Co. v. Dupre. 54 Fed. Rep., 640.
[8] Phettiplace v. N. P., 54 N. W. Rep., 1092.
[9] Smith v. Chamberlain, 17 S. E. Rep., 371.
[10] L. & N. R. Co., v. Mothershed, 12 South. Rep., 714.
[11] Hudson v. C., C. & C., 55, Fed. Rep., 248.
[12] Wallace v. Cent. V. R. Co., 33 N. E. Rep., 1069.
[13] Manson v. Eddy, 22 S. W. Rep., 66.
[14] Gle son v. N. Y. & N. E. R. Co., 34 N. E. Rep., 79.
[15] Harker v. B., C. R. & N. R. Co., 55 N. W. Rep., 316.
[16] Sleth v. Great North. R. Co., 55 N. W. Rep., 137.
[17] K. C., M. & B. v. Phillips, 13 South. Rep., 65.
[18] L. & N. R. Co. v. Wallingford, 22 S. W. Rep., 439.
[19] N. Y., C. & St. L. R. Co. v. Perigeuy, 34 N. E. Rep., 233.
[20] Campbell v. Walker, 22 S. W. Rep., 823.
[21] Crowe v. N. Y. Cent. & H. R. R. Co., 23 N. Y. S., 1100.
[22] R. & D. v. Powers, 13 S. Ct., 748.
[23] Christian v. Ill. Cent., 12 South. Rep., 710.
[24] Oatts v. C., N. O. & T. P., 22 S. W. Rep., 330.
[25] Rainey v. N. Y. Cent. & H. R., 23 N. Y. S, 80.

MEETINGS AND ANNOUNCEMENTS.

Dividends:

Dividends on the capital stocks of railroad companies have been declared as follows:

Boston & Maine, $3 per share on the preferred stock, payable March 1.

New York, Chicago & St. Louis, annual, 4 per cent. on the 1st preferred stock, payable March 1.

North Carolina, semi-annual, 3 per cent., payable March 3.

North Pennsylvania, quarterly, 2 per cent., payable Feb. 26.

Stockholders' Meetings.

Meetings of the stockholders of railroad companies will be held as follows:

Atlanta & Charlotte Air Line, annual, New York City, March 14.

Baie des Chaleurs. special, Montreal, Feb. 19.

Delaware, Lackawanna & Western, annual, New York City, Feb. 20.

Florida Central & Peninsular, annual, Jacksonville, Fla., March 1.

Grand River Valley, Jackson, Mich., April 25.

Gulf, Colorado & Santa Fe, annual, Galveston, Tex., March 6.

Missouri Pacific, annual. St. Louis, Mo., March 13.

Monterey & Mexican Gulf, special, New York City, Feb. 20.

New York, Lake Erie & Western, special, New York City, March 6.

Nicola Valley, special, Vancouver, B. C., Feb. 20.

Norfolk & Southern, annual, Norfolk, Va., March 1.

Northern Central, annual, Baltimore, Md., Feb. 23.

Pittsburgh & Castle Shannon, Pittsburgh, Pa., Feb. 20.

St. Louis, Iron Mountain & Southern, annual, St. Louis, Mo., March 13.

Western Terminal Co, special, Pittsburgh, Pa., Mar. 20.

Technical Meetings.

Meetings and conventions of railroad associations and technical societies will be held as follows:

The *Master Car Builders' Association* will hold its annual convention at Saratoga, N. Y., June 12. The hotel headquarters will be at Congress Hall, H. S. Clements, Manager.

The *Master Mechanics' Association* will hold its annual convention at Saratoga, N. Y., in June, immediately following the M. C. B. convention.

The *Freight Claim Association* will hold its annual meeting in Louisville, Ky., March 14.

The *New England Railroad Club* meets at Wesleyan Hall, Bromfield street, Boston, Mass., on the second Wednesday of each month.

The *Central Railway Club* meets at the Hotel Iroquois, Buffalo, N. Y., on the fourth Wednesday of January, March, April, September and October. The next meeting will be on Wednesday, March 28.

The *Southern and Southwestern Railway Club* will meet at the Kimball House, Atlanta, Ga., Thursday, April 19, at 10 a. m.

The *Western Railway Club* meets in the rooms of the Central Traffic Association, Monadnock Building, Chicago, on the third Tuesday in each month, at 2 p. m.

The *New York Railroad Club* meets at the rooms of the American Society of Mechanical Engineers, 12 West Thirty-first street, New York City, on the third Thursday in each month, at 8 p. m.

The *Northwest Railroad Club* meets at the Ryan Hotel, St. Paul, on the second Tuesday of each month, except during June, July and August, at 8 p. m.

The *American Society of Civil Engineers* meets at the House of the Society, 127 East Twenty-third street, New York, on the first and third Wednesdays in each month.

The *Canadian Society of Civil Engineers* meets at its rooms, 112 Mansfield street, Montreal, P. Q., every alternate Thursday.

The *Technical Society of the Pacific Coast* meets at its rooms in the Academy of Sciences Building, 819 Market street, San Francisco, Cal., on the first Friday in each month, at 8 p. m.

The *Tacoma Society of Civil Engineers and Architects* meets in its rooms, 201 Washington Building, Tacoma, Wash., on the third Friday in each month.

The *Association of Engineers of Virginia* holds informal meetings the third Wednesday of each month, from September to May, inclusive, at 719 Terry Building, Roanoke, at 8 p. m.

The *Boston Society of Civil Engineers* meets at Wesleyan Hall, 36 Bromfield street, Boston, on the third Wednesday in each month, at 7:30 p. m.

The *Western Society of Engineers* meets at 78 La Salle street, Chicago, on the first Wednesday in each month, at 8 p. m.

The *Engineers' Club of St. Louis* meets in the Missouri Historical Society Building, corner Sixteenth street and Lucas Place, St. Louis, on the first and third Wednesdays in each month. The next meeting will be on Feb. 21. The subject will be The Manchester Ship Canal, by John Dean.

The *Engineers' Club of Philadelphia* meets at the House of the Club, 1122 Girard street, Philadelphia, on the first and third Saturdays of each month, at 8 p. m.

The *Engineers' Society of Western Pennsylvania* meets at its rooms in the Thaw Mansion, Fifth street, Pittsburgh, Pa., on the third Tuesday in each month, at 7.30 p. m.

The *Civil Engineers' Club of Cleveland* meets in the Case Library Building, Cleveland, O., on the second Tuesday in each month, at 8 p. m. Semi-monthly meetings are held on the fourth Tuesday of each month.

The *Engineers' Club of Cincinnati* meets at the rooms of the Literary Club, No. 24 West Fourth street, Cincinnati, O., on the third Thursday in each month at 8 p. m.

The *Engineers' Club of Kansas City* meets in Room 200, Baird Building, Kansas City, Mo, on the second Monday in each month.

The *Engineering Association of the South* meets on the second Thursday in each month, at 8 p. m. The Association headquarters are at The Cumberland Publishing House, Nashville, Tenn.

The *Denver Society of Civil Engineers* meets at 36 Jacobson Block, Denver, Col., on the second and fourth Tuesdays of each month except during July, August and December, when they are held on the second Tuesday only.

The *Montana Society of Civil Engineers* meets at Helena, Mont., on the third Saturday in each month, at 7.30 p. m.

The *Engineers' Club of Minneapolis* meets in the Public Library Building, Minneapolis, Minn., on the first Thursday in each month.

The *Northwestern Track and Bridge Association* meets at the St. Paul Union Station on the Friday following the second Wednesday of March, June, September and December, at 2:30 p. m. The next meeting will be Friday, March 16.

Civil Engineers' Society of St. Paul.

The regular meeting of the Civil Engineers' Society of St. Paul was held at the society room on Feb. 5. Mr. C. A. Hunt described the repairs now in progress on the dam at St. Anthony Falls. Mr. Hilgard gave his theory of the failure of a portion of the roof of the St. Paul & Northern Pacific tunnel at Westminster street. The tunnel had a clear width of 28 ft., and was quite flatly arched with four concentric rings of brick at the crown, instead of five, as provided by its designer. In the course of seven years the crown of the arch had settled about one foot, and a cross section of the intrados showed a slightly sinuous line. Careful inspection failed to prove any definitely measurable displacement or settlement of the side walls. In settling, the brick rings separated from 1 to 3 in., as near as might be, on the line of greatest pressure, and but slightly elsewhere. For instance, at the crown the greatest open space had formed immediately below the external, and at haunches above the internal ring. The passage of this line of principal separation through intermediate rings in offsets corresponding to the radial joints was marked by longitudinal cracks.

In Mr. Hilgard's opinion the settling of the arch was due to the gradual grinding out of mortar from both ring and radial joints effected by the vibrations of roof and the jarring caused by the passing of heavy trains, and to the fact that traffic continued through the tunnel during its construction.

Furthermore the arch lacked the lateral support and surcharge of the contemplated filling which had been indefinitely postponed. The weight and bulk of this

fill, if made, would have considerably checked the vibrations. Mr. Hilgard suggested that the lesson taught by this case was, that for similar arches under like conditions cut stone should be used instead of brick; that should it be necessary to use brick, cut stone blocks should be inserted at proper intervals to form a bond between the several rings. Further, that arches exposed to vibrations and jarring should be built considerably heavier than the load alone required.

Mr. Münster followed Mr. Hilgard with some remarks on the measurement of water in connection with the test of a pumping engine of 6,000,000 gals. capacity, and showed an original diagram for weir measurements, giving quantities in cubic feet per second from gage readings for all weirs up to 10 ft. in length.

President Wilson exhibited some topographical maps of the Connecticut State survey.

New York Railroad Club.

At the meeting, Feb. 15, Mr. R. A. Parke read a paper entitled "The Vertical Influence of Counterbalancing."

American Institute of Mining Engineers.

The following are the candidates at the forthcoming election of the American Institute of Mining Engineers: For President, John Fritz, Bethlehem, Pa.; for Vice-Presidents, J. F. Holloway, New York City; J. C. Platt Waterford, N. Y.; E. V. d'Invilliers, Philadelphia, Pa.; for Managers, T. A. Rickard, Denver, Col.; H. O. Hofman, Boston, Mass.; John A. Church, New York City.

Engineers' Club of St. Louis.

The club met on Feb. 7, President Crosby in the chair, 39 members and 11 visitors present. A. J. Hammond and M. L. Mitchell were elected members.

A committee of five was appointed by the President to confer with a similar committee appointed by the St. Louis Chapter of the American Institute of Architects, to consider the feasibility of a system of boulevards in the central part of St. Louis.

Prof. J. B. Johnson addressed the club in regard to the Testing Laboratory of the Washington University, and the timber tests now in progress there, under the auspices of the Forestry Division of the Department of Agriculture. The construction and uses of the various testing machines were explained, after which the meeting adjourned to the laboratory itself, on Seventeenth and St. Charles streets, where cross-breaking tests were made on yellow pine beams 4 × 4 and 8 × 14, and a compression test on yellow pine columns 10 in. square and 12 ft. long.

At the next meeting on Feb. 21, the Manchester Ship Canal will be described by John Dean.

Master Car-Builders' Association.

The committee on heating passenger equipment has issued a circular requesting replies to the following questions, to aid it in its report to the association in convention next June: 1. Do you use automatic pressure-reducing valve on steam pipe at locomotive? 2. What pressure do you recommend for train pipe at outlet of reducing valve? 3. Do you use automatic pressure-reducing valve on each car? 4. Have you adopted the size and location for end of train pipe recommended by the M. C. B. Association? 5. Do you recommend the use of iron or brass hose nipples? 6. What is about the average time of service of steam hose on cars? 7. What steam coupling do you use? 8. What do you use for train-pipe cocks? 9. Where do you locate train-pipe cocks? 10. How many cars have you heated by direct-steam radiation? 11. How many square feet of direct steam-radiation surface do you use for a 50-ft. car? 12. Do you use a device for controlling temperature in cars? 13. Do you use a regulating valve operated by trainmen? 14. Do you use an automatic device for controlling the temperature? 15. If so, what device? 16. Have you had good results with automatic devices for controlling temperature of cars? 17. How many cars have you steam heated by hot-water circulation? 18. Do you use jacketing systems? 19. Have you had satisfactory results with jacketing systems? 20. Do you use commingling systems? 21. Have you had good results with commingling systems? 22. Do you find any difficulty in controlling the temperature of cars heated by the hot-water system? 23. How is the water of condensation disposed of? 24. Do you have trouble with the water of condensation freezing? 25. Do you experience trouble in having the drips properly adjusted? 26. What is the difference in condensation between direct steam radiation and hot-water circulation? 27. Which system do you recommend? 28. Do you have stoves in cars for use in case of emergency? 29. Do you advise keeping direct steam-heated cars warm at terminals?

Answers to this circular should be sent to the Chairman, Mr. W. L. Hoffecker, C. R. R. of N. J., Elizabethport, N. J., not later than April 10.

The Traveling Engineers' Association.

Secretary W. O. Thompson has issued a circular asking the following questions on behalf of the Committee on "What are the Best Means of Saving Coal and Increasing or Holding the Mileage per Ton at a Desirable Figure?" It is requested that members give their opinions on the subject, as a whole, and offer any suggestions they may see fit.

1. What time do you allow in round house for getting up steam on your engines for regular and other trains? 2. Are your hostlers and firemen instructed to keep a light fire in engine to avoid blowing off steam while engine is waiting for train? 3. Are your freight trains always ready to leave on time ordered? 4. What is the average time your engines are waiting for train (a) passenger; (b) freight? 5. Do you estimate the amount of coal consumed while engine is waiting for train? 6. While on the road, do your firemen exercise the necessary care in firing the engine to avoid blowing off steam? 7. Do your firemen observe the engineer's shutting-off points along the road? 8. Do you allow your firemen to put in a fire at shutting-off points? 9. If so, why? 10. Do you dump the fire on your engines at terminal stations? 11. When banking fires on engines, waiting several hours for trains, do you retain fire against front or back end of firebox? 12. Is it your practice to bank fire against the flue sheet? 13. If so, why? 14. In your experience, do you find the brick arch a medium for saving coal? 15. Can locomotives on your road be fired successfully without the use of hooks and rakes? 16. What kind of coal used on your engines? 17. Does bituminous coal used on your engines clinker? 18. By what means do you avoid clinker? 19. What styles of grates are on your engines? 20. Give dimensions of air space in and between grate bars. 21. On your road what is the average car-mile per ton of coal on passenger? on freight? 22. On your road what is the average grade per mile; average length of grade? 23. Have you tried the plan of paying premiums to the engine crew showing the most economy in coal? 24. What is your opinion of the premium system? 25. If premiums are paid, should they be given for greater mileage per ton in the month, or for greater improvement made over previous months? 26. Would the last named plan encourage the poor or indifferent fireman to try to better his record? 27. Does your company employ a traveling fireman? 28. If you do not pay a premium, what course do you pursue to encourage your engineers and firemen to save coal? 29. Do you furnish your engineers and firemen any literature bearing on the subject of combustion of coal in locomotive fireboxes? 30. Is your coal put on the tenders by buckets or chutes? 31. Is your service such that your actual mileage is acquired by hauling train the full miles, or do you have a round house a considerable distance from terminal, and the miles run with an empty engine counted in as actual service with a train? 32. How many miles per hour do you allow engines in switching or construction service? 33. What number of miles do you consider it practical for an engine to run before overhauling, as regards fuel consumption? What is the practice on your road? 34. Have you fast freights; if so, in what proportion to other through freights? 35. Are your engineers called to a strict account for a loss of time on freight or passenger? If so, give the minimum time lost that will call for a statement? 36. Is 10 minutes' time on passenger, or 30 minutes' time on freight considered by your management worth a ton of coal? 37. How many miles do your engines run before the flues are removed for cleaning the boiler? 38. What front end do you use, extension or short? Which pattern of the above gives the best results, all things considered? Does one require more attention than the other on the road; and will one hold up on steam at the last end of the run as well as the other? 39. Have you any engines built with the firebox on top of frames? If so, what results do you notice as compared with the standard box? 40. Do you consider black smoke imperfect combustion? Are your engines fired with a view to alleviate it?

Answers should be sent to Mr. M. Mast, Chairman (Chicago & Erie) Huntington, Ind.

Central Railway Club.

The annual meeting of the Club was held at Buffalo on Jan. 24. President Waitt made an address speaking of the work of the Club during the year and its present condition. The Secretary reported that 41 members had been elected during the year, the membership being now 193. A report on the inspection and maintenance of air-brakes presented by J. A. Chubb, took the ground that air-brakes on freight cars have not received the attention that they deserve. The inspection and tests now made are, as a rule, by the ordinary inspector, and with yard engines expensive, necessarily limited and unsatisfactory. Inspection is subject to three forms—inter-change, terminal and division points, and shop, each having a special object in view. Aside from the unimportant outside repairs, work on air-brakes should not be done by the ordinary car repairers nor by any unauthorized person. The need of an automatic adjuster for taking up the slack in freight car brakes was noted.

The special committee on leaky boiler flues presented a report, from which the following is abstracted: Leaky tubes were attributed to several causes. The first of these and the most difficult to deal with is due to bad water. These deposits do not deposit equally on all parts, but have a peculiarity of filling corners. Other causes are the unequal and spasmodic circulation of the water, upward and behind the flue sheets, and unequal heat in the firebox; the latter is again due to varying conditions of the fire and of the service the locomotive may have to perform, with a resulting expansion and contraction of the tubes in their diameter, the effect being in proportion to the diameter of the tube. Another cause of expansion and contraction with resulting injury is by running with the firebox door open, admitting air of lower temperature to the tubes, and again by the admission of air through a thin fire or through holes in it. With the long firebox the effect is not so great as with the short firebox.

The committee do not think that the workmanship is an important factor in the problem, but believe that the causes mentioned are the main ones.

The amount of work a locomotive has to do in a given time has increased the intensity of the causes of leaking tubes in a ratio with the work; a larger diameter of tubes has also added to the evil of expansion and contraction, and the higher pressure of to-day is responsible for its proportion of the trouble.

The committee does not incline to the belief that the longitudinal expansion of the tubes has any perceptible effect upon them; did it do so, the front or firebox end of the tube would then give trouble.

As a preventive, they recommend that the sudden cooling of the tube should be avoided. Water should be fed steadily, the fire kept in good condition at the front end, of sufficient thickness to prevent air entering; running with the fire door open is injurious, and ash-pan dampers should be used and fitted to be effective; flues should be kept clean of cinders or fuel of any kind. In washing out boilers hot water should be used, and blowing-off boilers preparatory to washing them should be avoided. They also find that the method of setting flues giving the best result is the use of copper ferules, and that the thickness of the copper used should depend upon the tube hole in the sheet, and increasing as the hole may become out of round; that flues should be driven into the sheet in the fire end, rolled to firmly fill the hole and then beaded, and that unnecessary rolling beyond that point is an evil.

The report was discussed by Messrs. Mackenzie, Campbell, West, Ames, Small, Miller, Snyder, Foster and Smith.

The election of officers resulted as follows: President, A. M. Waitt; Vice-President, S. Higgins; Secretary and Treasurer, S. W. Spear; Assistant Secretary, Harry D Vought; Executive and Financial Committee, A. M. Waitt, T. A. Bissell, George W. West, John D. Campbell, C. E. Rood, O. P. Letchworth and P. H. Griffin.

The committee recommended that article 4, section 2, of the constitution be amended so as to read that officers shall be elected at the annual meeting for the term of one year, without nomination, and by written ballot in open meeting; that the presiding officer shall not succeed himself, and the office shall alternate between a Master Car Builder and Master Mechanic.

PERSONAL.

—Mr. Frederick Bishop has resigned as Superintendent of the Pottsville Iron & Steel Co., Pottsville, Pa.

—Dr. Henry F. Hoyt, of St. Paul, Minn., has been appointed Surgeon in Chief of the Chicago, Burlington & Northern, to succeed Dr. J. H. Murphy, deceased.

—Mr. J. A. Droege, formerly Superintendent of the Middle Georgia & Atlantic, has accepted a position with the Florida Central & Peninsular at Jacksonville, Fla.

—Mr. Alfred Merritt has retired from the Presidency of the Duluth, Missabe & Northern, and Mr. Leonidas Merritt, Vice-President, and Mr. C. C. Merritt, Treasurer, have also resigned.

—Mr. A. A. Zion, for several years Chief Train Dispatcher and Trainmaster of the Indianapolis Union, has been appointed Superintendent of the road, with headquarters at Indianapolis, Ind., to succeed D. F. Whitcomb, resigned.

—Mr. Joseph Wolf, of the firm of Wolf & King, railroad contractors, died at Duluth, Minn., of smallpox, on Feb. 8. Mr. Wolf was well known throughout the Northwest, where he had done considerable railroad building. Last summer the firm completed the construction of the Duluth, Missabe & Northern. He had built several pieces of road in Wisconsin, as well as the Duluth & Iron Range, in Minnesota.

—Major James O. Moore, of Baltimore, Md., a civil engineer on the Baltimore & Ohio, and who was for a long time Right-of-Way Agent, and had charge of this work on the Philadelphia Division of the road, died of consumption at Hancock, Md., on Feb. 2. Major Moore built the Port Royal & Augusta road, and the Fairmount, Morganstown & Pittsburgh and the Grafton & Belington branches of the Baltimore & Ohio. He was also engaged on the improvements at Harper's Ferry, W. Va.

—Mr. Oscar V. Smith, Traffic Manager of the Seaboard Air Line for many years, died at his home in Portsmouth, Va., on Feb. 7. Mr. Smith had been in ill health for some time. Last November he made a trip to Europe, from which, however, he received little benefit and he did not resume active railroad work. Mr. Smith became Traffic Manager of the Seaboard Air Line when that route was first formed, having been previously Assistant Superintendent of the Seaboard & Roanoke at Portsmouth and General Claim Agent.

—Mr. Homer Ramsdell, of Newburg, N. Y., for many years identified with transportation interests in eastern New York, died at his home at Newburg on Feb. 13, in his eighty-fourth year. His chief interests were as a member of the firm of Thomas Powell & Co., of Newburg, operating boats on the Hudson River, and as President of the Ramsdell Transportation Co. About 1850 he was elected a director of the New York & Erie Railroad, and was largely instrumental in having the branch of that road built from the main line near Chester to Newburg. His firm subscribed $15,000 toward that enterprise. He was also identified with other extensions of the Erie Railroad, of which he was elected President in 1853.

—Mr. William P. Watson, of Seattle, Wash., has been appointed Surveyor General of Washington. Mr. Watson has been for the past 15 years engaged in engineering practice in Washington. In 1879 he was in the service of the Northern Pacific, and for two years had charge of construction in the Missouri canyon. He went to the Canadian Pacific in 1881, and was for three years locating the road from Kamloops to the summit of Shuswap Mountains, about 200 miles, and in charge of construction. He was then engaged for three years on the Montana Central on location. For two years he was in the employ of the Union Pacific, locating the line from Mullan, Idaho, to Missoula, Mont., and for one year as Engineer of the Portland & Puget Sound preliminary surveys. Early in 1890 Mr. Watson became Principal Assistant Engineer on the Seattle & Montana road, one of the Great Northern lines, having charge of location and construction. He completed the line and turned it over to the operating department in 1892. In 1893 Mr. Watson had charge of the surveys and estimates for the United States commission for the improvement of the Columbia River at The Dalles, Ore.

—Mr. Abraham Gottlieb, of Chicago, well known as a civil engineer, died suddenly in the Rookery Building, in that city, on Feb. 10. Mr. Gottlieb had just entered the building and was approaching the elevators when he became faint and sank to the floor, expiring in a few minutes. Mr. Gottlieb was born in Bohemia and was about 56 years of age. He came to the United States in 1866 and immediately engaged in civil engineering work in Chicago. His attention was chiefly devoted to bridgework, and as a contracting engineer he carried out some important works. Probably his most important contract in this line was that on the Duluth, South Shore & Atlantic, for the designing and erection of all the bridges on that road. He represented the Keystone Bridge Co. at Chicago, and for several years was President of the company. He also acted for the Edge Moor Bridge Works, at Chicago, at one time, but for the past 10 years he had an office as consulting and contracting engineer at Chicago. He was Consulting Engineer of the World's Fair, but resigned before the opening of the Exposition. He has served as President of the Western Society of Engineers and since 1872 had been a member of the American Society of Civil Engineers, and at the time of his death was a director of the society. Mr. Gottlieb had many very fine qualities and was scrupulously fair and honorable in his business transactions. He enjoyed the friendship and regard of the most eminent members of his profession.

ELECTIONS AND APPOINTMENTS.

Brooklyn Elevated.—Since the annual meeting of the stockholders in January, a number of changes have been made in the management, the present officers of the company being as follows: Adolph Ladenberg, President; Anthony Barrett, Vice-President; Isaac D. Barton, General Superintendent; O. F. Nichols, Chief Engineer; W. B. Longyear, Auditor; Elbert Snedecker, Secretary and Treasurer; George W. Edwards, Superintendent; E. P. Mallinson, Master Mechanic; and J. H. Simmons, Roadmaster.

Chicago & Northwestern.—M. Riney has been appointed Superintendent of Bridges and Buildings of the Madison Division, with headquarters at Baraboo, Wis.

Duluth, Missabe & Northern.—The annual meeting was held in Duluth, Minn., Feb. 6, and the following directors were elected: A. D. Allibone, N. B. Merritt, A. D. Thomson, W. J. Olcott, J. B. Cotton, Alexander McDougall, S. R. Payne, H. C. Merritt, D. M. Philbin. The Presidency has not been filled, but the officers elected are: Vice-Presidents, A. D. Allibone and Alexander McDougall; Secretary, S. R. Payne; Treasurer, A. D. Allibone; General Counsel, George W. Murray; Attorney, J. B. Cotton; General Manager, D. M. Philbin, Duluth, Minn.

Florida Midland.—Receiver Henry S. Chubb announces the appointment of J. M. Booth, formerly

Auditor, as Superintendent, with headquarters at Kissimmee, Fla.

Huntingdon and Broad Top.—At the annual meeting held in Philadelphia, Pa., Feb. 6, the following directors were elected: James Long, James Whitaker, Thomas R. Patton, Jacob Naylor, William Bault, Samuel Bancroft, Jr., Johns Hopkins, George H. Colket, Robert H. Crozer, William H. Shallcross, Lewis A. Riley and Harrison K. Caner. Spencer M. Janney was elected President.

Missouri Pacific.—M. E. Bowles has been appointed Division Superintendent with headquarters at Osawatomie, to succeed T. F. Dunaway, resigned.

New London Northern.—The annual meeting was held in New London, Conn., and the following directors were elected: Robert Coit, Augustus Brandegee, C. A. Williams, J. N. Harris, New London; Thomas Ramsdell, Windham; J. H. Rumrill, Springfield, Mass.; C. H. Osgood, Norwich; Thomas B. Eaton, Worcester, Jeremiah Halsey, Norwich. The officers elected were: Robert Coit, President and Treasurer; J. A. Southard, Secretary, both of New London, Conn.

New York & New England.—Thomas C. Platt and Marsden J. Perry, Receivers, have announced the following appointments: Vice-President J. T. Odell, appointed General Manager for the Receivers; Geo. F. Randolph, General Traffic Manager; Geo. B. Phippen, Treasurer; James W. Perkins, Secretary; and W. H. Dudley, Auditor.

Philadelphia & Erie.—The following directors were elected at the annual meeting held in Philadelphia, Pa., Feb. 12: N. Parker Shortridge, W. Hasell Wilson, John P. Green, Samuel Gustine Thompson, J. Bayard Henry, William L. Elkins, Henry D. Welsh, William J. Howard, Amos R. Little and W. H. Barnes.

Rome, Watertown & Ogdensburg.—Chauncey J. Stedwell, formerly Division Superintendent on the Cleveland, Cincinnati, Chicago & St. Louis, has been appointed a trainmaster of this road.

Tampa & Thonotosassa.—This road has been recently opened for traffic and the following officers have been elected: B. R. Swoope, Superintendent, Sanford, Fla.; C. D. Owens, Freight Traffic Manager, Savannah, Ga.; W. M. Davidson, Passenger Traffic Manager, Jacksonville, Fla.

Union Pacific.—J. J. Painter, formerly Roadmaster of the Julesburg branch, has been appointed Superintendent of the Cheyenne & Northern Division.

Union Pacific, Denver & Gulf.—Superintendent Dunaway has appointed the following as Division Superintendents: J. K. Painter, headquarters Sterling, Col.; John B. McCormick, headquarters Denver; M. F. Egan, headquarters Pueblo, Col. J. P. Bay has been appointed Master Mechanic, with headquarters at Denver, Col.

Williamsville, Greenville & St. Louis.—The following are the officers of this road, which was recently chartered in Missouri: Edward S. Orr, St. Louis, Mo., President; H. N. Holladay, Vice-President and General Manager; and C. W. White, Williamsville, Mo., Secretary and Treasurer.

RAILROAD CONSTRUCTION, Incorporations, Surveys, Etc.

Baltimore & Cumberland.—The surveying work on this road between Cumberland and Hagerstown, Md., is again being renewed. The party under Engineer Murdock is reported to be revising the line on the eastern portion between Hancock and Hagerstown. The right of way is being acquired steadily. During the past few weeks a number of railroad contractors have been over the line before submitting bids for construction.

Bayfield Harbor & Great Western.—In a short time the citizens of Bayfield County, Wisconsin, will vote on the proposition to extend the time in which the $50,000 bonds voted to this road may be earned. The proposition may be changed, as Iron River is anxious to have the road built. In that event it is probable that the amount of the bonds to be voted upon will be $100,000.

Canadian Roads.—The following companies are applying to the Dominion Government for incorporation: The Wolseley & Fort Qu'Appelle, with power to construct a road from Wolseley, N. W. T., to Fort Qu Appelle, a distance of 40 miles; the Duluth, Nipegon & James Bay, to construct a line from Nipegon, Ont., to James Bay, near the mouth of the Albany River; the Lake Megantic, to construct a line from Lake Megantic, Quebec, to the international boundary line, near Dead River.

Chesapeake & Ohio.—This company has begun work again on the extension of its line from the mouth of Guyandotte River, in West Virginia, to Logan Court House, in the same state. The surveys were begun last spring, but were abandoned during the money stringency. A few weeks ago engineers went to work again on what is supposed to be the final survey, and have reached the Logan County line, above Guyan Falls, nearly half way. The line will be about 40 miles in length and will develop coal and timber lands.

The 20 mile branch of this road has been completed and turned over to the operating department. This branch begins at Belva, the terminus of the Gauley Branch, and extends to Morris, W. Va., about eight miles.

Choctaw Railway & Coal Company.—The bill introduced in Congress some time ago to extend the time for the construction of this railroad was passed by the Senate last week and has since been signed by the President. The plans for reorganizing the property are now, it is said, in a fair way to be carried out successfully, and an effort will be made to complete the unfinished portion of the road through Oklahoma from South McAllister to Oklahoma, a distance of about 120 miles. Francis I. Gowen, of Philadelphia, one of the Receivers, is now in Oklahoma in connection with the reorganization and extension of the line.

Coast Railway of Nova Scotia.—A dispatch from Yarmouth, N. S., says that the first party of engineers engaged by the New York capitalists who are going to build this road from Yarmouth to Lockport have arrived. Among them are R. L. Uniacke, formerly of Halifax, W. W. Wells, the company's chief engineer, with another party, will arrive in a few days. The survey will be commenced at once and the work of building pushed right on. R. H. Chadbourne, 29 Broadway, New York, is the contractor for the road.

Delaware, Susquehanna & Schuylkill.—This road is building a branch line about one mile in length to connect with the Lehigh Valley at Lumberyard Station, Pa. This will make the third junction point of this road with the Lehigh Valley.

Duluth & Winnipeg.—The preliminary survey for the extension of the road to connect with the Minneapolis, St. Paul & Sault Ste. Marie at Carrington, N. D., has been stopped and the surveyors recalled.

Dry Fork.—This company, which is building a railroad from a connection with the West Virginia Central & Pittsburgh road, in West Virginia, to the headwaters of Dry Fork River, by way of the Cheat River Valley, has completed the grading as far as Harmon, and has removed its headquarters to that point. Two hundred men are at work on the line, and the work is being pushed rapidly. It is expected to have the ties and rails down as far as Harmon, which is nearly half way on the line, by the middle of March, and to have trains running that far a few weeks later.

Eastern Nebraska & Gulf.—The charter for this road was filed in Nebraska last week by F. A. Seaman and W. C. McNamara, of Sioux City, Ia., the former being connected with the Sioux City & Northern road. The charter provides for a line from Sioux City, crossing the Missouri River to Nebraska, and southwest across that state. Mr. Seaman is reported as having said that the surveying will be commenced this month, and that probably 50 miles will be surveyed before the winter weather breaks up.

Easton & Elkton.—A certificate of incorporation of the company was filed at Annapolis Md., last week. The road is to extend from Easton to Chestertown, Md., the capital stock being $200,000. The incorporators are Joseph B. Seth, James A. Pearce, Samuel C. Howland, Theophilus Tunis and Wm. R. Martin. The proposed road is an extension of the Baltimore & Eastern Shore Railroad.

Kansas, Oklahoma & Southwestern.—The organization of this company was completed last week, when officers were elected at Perry, Oklahoma. They announce that the surveying will begin at once from Coffeyville, Kan., the proposed northern terminus of the line. The charter secured provides for a line from that point southwesterly across Oklahoma, passing through the important towns in that territory and thence into Texas. The directors are Robert Martin (President), S. M. Porter, John R. Clark and Robert Lowry.

National Tehuantepec.—Chandos S. Stanhope, of the City of Mexico, who has the contract to complete this road, has returned from the isthmus, where he says 1,200 men are at work. It is expected that within eight months regular trains will be running from the Gulf to the Pacific. During January 7 kilometres of track were laid, leaving a gap of 52 kilometres between the ends of track. The wooden bridge over the River Jaltepec, 700 ft. long, has been finished and the iron structure, 270 ft. long, will be ready this month.

Wood & Childs, who recently purchased a large tract of standing timber along Pine Creek, 13 miles from Cammal, Pa., have made arrangements to build a line from the latter place to the timber. Work is to begin at once.

New Roads.—Judge John O. Perry, of Newton, Ga., is organizing a company to build a branch from Newton through Baker County to connect with the Savannah, Florida & Western at Camilla. The distance is about 10 miles and some of the grading was done several years ago by a former company.

Norfolk & Western.—The District of Columbia Commissioners have completed their report on the bill introduced into the United States Senate by Senator Hunter, of Virginia, to authorize this company to extend its line into the District of Columbia. The bill provides for a line from the Virginia side of the Potomac River, crossing the river near the "Three Sisters," then following on the east bank of the river to Georgetown, and to a point on Rock Creek south of the K street bridge. The terminus in Washington city is to be west of Twenty-sixth street, between Pennsylvania and Virginia avenues.

Ohio Southern.—The reports of the proposed extension of this road from Wellston, O., to Portsmouth, O., find some confirmation in a bill introduced in the Ohio Legislature to allow the road to occupy the berme bank of the canal between Cincinnati and the Ohio River at Portsmouth.

Pennsylvania.—The building of the branch line to the steel works of the Johnson Company at Johnstown, Pa., is now apparently assured. General Superintendent Sheppard and A. C. Shand, Division Engineer, spent some time at Johnstown, Pa., last week in consultation with the officers of the Johnson Company and others interested in the new line. The branch will be short, but will be through some rough and difficult country for construction. The Pennsylvania has for some time been considering plans for building into Johnstown and the matter is brought up at the present time through the action of the officers of the Johnson Company who have insisted that unless they secured better railroad facilities than the Baltimore & Ohio furnish they would be compelled to move part of their plant from Johnstown. The Pennsylvania engineers have upon previous occasions made surveys over several routes for this Johnstown line, and one of these will probably be decided upon shortly.

Point Pleasant, Buckhannon & Tygarts Valley.—This project has been again taken up recently and at a meeting of the stockholders at Buckhannon, W. Va., last week, it was decided to apply to the county court of Upshur County, W. Va., to order a special county election to vote on a proposition to issue $10,000 in aid of the road. The court has since taken this action. The new road is to build a connecting line between the West Virginia & Pittsburgh at Buckhannon and the West Virginia, Central & Pittsburgh at Belington, W. Va, and it is said that those roads will assist to some extent in the construction of the new line. The surveys were made early last year and part of the right of way was then secured. The building of this connecting link would give a line direct from Baltimore through the connection with the Baltimore & Ohio at Belington to the lower terminus of the West Virginia & Pittsburgh road at Addison, Webster County, and will, with the building of the projected Elk River railroad of the latter company, reach Charleston, W. Va., and the Ohio River by way of the Kanawha & Michigan, which is now connected with the Chesapeake & Ohio. It would also give an independent connection with the Chesapeake & Ohio, by way of the new road up Twenty Mile Creek. Messrs. J. W. Heavener, J. H. Hanson and W. T. Burnside, of the new corporation, will meet the officers of the West Virginia Central & Pittsburgh road in Baltimore this week to discuss the plans.

Portland & Rumford Falls.—The extension to connect with the Maine Central near Auburn, Me., which has been building since last July, was opened for regular passenger traffic on Feb. 8. The extension is about 12 miles long from Mechanic Falls east to Auburn, near Lewiston. The trains will run from the latter town to Mechanic Falls and to the terminus of the road at Rumford Falls.

Richmond & Petersburg.—Several routes have been surveyed for a belt line around Petersburg, Va., and another is now being surveyed. This latter route begins south of Petersburg and passes around the city, through the counties of Dinwiddie and Prince George, connecting with the Norfolk & Western. The distance of this line is about three miles.

Rutledge & Julian.—This road is only four miles long from Rutledge to a connection with the Alabama Midland at Julian, but it has taken several months since the completion to open it for general traffic. This opening took place last week.

Savannah & Atlantic.—Justice Jackson, of the United States Supreme Court, last month directed the Receivers to rebuild this road between Savannah and the sea coast, about 10 miles, which was washed away in the South Atlantic Coast storms of the spring of 1893. The Receivers have so far been unable to secure funds for rebuilding the line through the sale of the Receivers' certificates which they were authorized to issue. Chief Engineer Hunter, of the Central of Georgia, estimates that the line can be made ready for operation for about $35,000, and it is said that several contractors have agreed to repair the road for that sum. The order of the court to rebuild the road was secured in a suit instituted by the bondholders when the Receivers declined to do so, and they have now been appealed to take up the Receivers' certificates, and that proposition is now being considered.

St. Louis, Avoyelles & Southwestern.—This company was recently formed in Louisiana to build a road from a point on the Texas & Pacific near the town of Bunkie in Avoyelles Parish, through that parish northeast to the Red River, passing through the towns of Evergreen, Cottonport, Marionville, Mausura and Marksville, a distance of 30 miles. It is the intention of the company to extend the road across the Red River and connect with the St. Louis, Iron Mountain & Southern at a point in Caldwell Parish. The route will be through a fertile and well cultivated portion of the state, which at present is without transportation facilities.

A preliminary survey has been made and a permanent survey is now being made by J. W. Sylvester, Chief Engineer. It is stated that the prospects are favorable for beginning active work shortly. The Parish of Avoyelles has been asked to vote a 5 mill tax for 10 years in aid of the road, and if the result is favorable, work will be begun at once. The officers state that the contracts for grading will be let in March. The maximum grade is 10 ft. to the mile. There will be a wooden drawbridge; a bridge 150 ft. in length; a trestle nearly 4,000 ft. in length; and three or four short trestles. The officers of the company are: F. M. Welch, President; E. H. Cochran, Secretary, and Ira W. Sylvester, Chief Engineer, all of Alexandria, La.

Sumter, Take City & Conaway.—The grading is now reported under way on this new road near Sumter, S. C. H. W. Mackey, of Sumter, the President of the road, reports that 10 miles will be built at once. The extension beyond that town will depend upon his success in forming a construction company to carry on the work. The proposed line is from Sumter north to Take City and Smithville and to Conaway, a total distance of 80 miles.

Tuscarora Valley.—A mortgage for $180,000 in favor of the New York Security & Trust Co. has been recorded recently by the officers of this company. The mortgage is given, it is understood, for the extension from East Waterford south toward Fannettsburgh, Franklin County, Pa., which the officers have apparently finally decided to build. Some grading was done on the line last fall, but work was soon discontinued and it was supposed that the project was abandoned on account of the Newport & Sherman Valley extension building into the same district.

Williamsville, Greenville & St. Louis.—This company, which was recently incorporated in Missouri, has purchased the Williamsville, Greenville & Northeastern Railroad, operating about 17 miles of standard gage road from Williamsville to Greenville, Mo. The new company proposes to extend this line a considerable distance, but as yet the objective point has not been definitely fixed upon. No surveys have been made and the chief engineer has not yet been selected. Edward S. Orr, Vice-President of the old company, is the President of the new company. H. N. Halladay, of Williamsville, Mo., is General Manager.

GENERAL RAILROAD NEWS.

Atchison, Topeka & Santa Fe.—Below is given a table showing the earnings and expenses of this road for the month of December, and for the six months of the fiscal year to Dec. 31:

Month of December.	1893.	1892.	Inc or dec.
Av. operated mileage..	7,480	7,480	
Gross earn.....	$3,060,8.0	$3,396,234 D.	$335,374
Oper. exp	2,280,690	2,432,566 D.	151,876
Net earn.....	780,170	963,668 D.	183,498
Other receipts.....	40,000	75,000 D.	35,000
Total net earn.....	$820,170	1,038,668 D.	218,498
½ annual fixed charges (est.)	942,000	919,000 I.	23,000
Surplus..... ..... (def.)	$121,830	$119,668 D.	$241,498
Six months to Dec. 31:			
Av. operated mileage... .. .	7,480	7,480	
Gross earning	$19,322,501	$21,827,865 D.	$2,305,361
Oper. expen.....	12,885,357	14,574,050 D.	1,688,693
Net earnings.....	$6,637,147	$7,253,815 D.	$616,628
Other receipts.....	310,000	450,000 D.	140,000
Total net earnings.....	$6,947,147	$7,703,815 D.	$756,668
½ annual fixed charges (est.)	5,652,000	5,514,000 I.	138,000
Surplus.....	$1,295,147	$2,185,815 D.	$894,668

The report for the aggregated general system including the St. Louis & San Francisco is as follows:

Month of December:			
Av. oper. mileage.	9,344	9,344	
Gross earnings.....	$3,686 942	$4.168,299 D.	$481,357
Oper. expen.	2,775,127	2,955,461 D.	180,334
Net earnings.....	$911,815	$1,212,838 D.	$301,023
Surplus ..... (def.)	$275,185	$93 838 D.	$369,02

Six Months to Dec. 31:	1893.	1892	Inc. or dec.
Gross earnings	$23,762,565	$26,919,128	D. $3,156,563
Oper. expen.	15,667,566	17,654,614	D. 1,987,048
Net earnings	$8,094,999	$9,264,514	D. $1,169,515
Surplus	$1,042,999	$2,550,514	D. $1,507,515

The St. Louis & San Francisco earned $626,083 gross in December, 1893, as against $772,065 for the same period of 1892. The net earnings were $131,646 in 1893, a decrease of $117,525 or 47 per cent. The gross earnings for the six months were $4,240,061 as against $5,091,264 in 1892, a decrease of 17 per cent. The operating expenses were 63 per cent. of the gross earnings for 1893, and after deducting fixed charges there is a deficit of $252,147 as compared with a surplus of $360,700 in 1892.

Baltimore & Lehigh.—The Pennsylvania portion of this road will be sold in March by an order of the County Court at York, Pa., under a judgment for $261,000 held by W. F. Walworth, of Cleveland, who made the application for the sale last week. This road is a narrow gage line extending from Baltimore to Delta, Md., and to York, Pa., but the Maryland and Pennsylvania sections are operated by different Receivers representing the conflicting interests. The order of sale affects only the portion between York and Delta, 34 miles, and not the southern portion of the line. There was a mortgage of $250,000 on the Pennsylvania section of the road, which was formerly the York & Beach Bottom road. The Baltimore & Lehigh was formed in 1892 by the consolidation of that road with the old Maryland Central. It is said that the sale of the Pennsylvania section will not affect the rest of the road.

Cape Fear & Yadkin Valley.—The Baltimore first mortgage bondholders have appointed a committee to protect their interests in view of the reported sale of the controlling interests of the railroad to a European syndicate and to obtain further information about that reported sale, of which nothing has so far been published beyond the simple statement that the control has passed from its former owners, the North Carolina Improvement Co.

Chattanooga, Rome & Columbus.—Eugene E. Jones, of New York City, was appointed a separate Receiver for this railroad by the Georgia Circuit Court at Atlanta, Ga., on Feb. 3. This road has been operated by the Receiver of the Central of Georgia as part of the Savannah & Western Division, but recently the bondholders of the property petitioned for the appointment of an independent Receiver. The road extends from Griffin, through Rome, to Chattanooga, a distance of 200 miles.

Chicago & Northwestern.—Kuhn, Loeb & Co., of New York, offered for subscription this week $2,000,000 of this company's five per cent. debenture bonds. These bonds form the remaining part of an issue of $10,000,000 made by the company in 1891 for providing in part for the cost of permanent improvements.

Denver, Apex & Western.—This road was sold at Denver on Feb. 13 for $50,000 by the Sheriff on a default in interest and taxes. The road was originally projected for a direct line west of Denver through the mountains.

Duluth, Missabe & Northern.—A second mortgage for $350,000 has been filed. It is understood that the funds realized from the sale of the bonds secured by this mortgage will be used in discharging the floating debt of the company, and in providing for certain betterments and extensions. The property is now practically under the control of the Rockfeller interests.

Georgia Southern & Florida.—The suit brought by the Mercantile Trust Co., of Baltimore, representing the bondholders, for the appointment of a co receiver to act with W. B. Sparks, of Macon, Ga., came up for trial at Macon on Feb. 5 in the Georgia Superior Court. The Mercantile Trust Co. is the trustee of the first mortgage bonds, amounting to $3,420,000, on which there is over $500,000 overdue interest. The trust company secured an order last November for the foreclosure sale of the road this March, but the date of the sale has recently been extended, pending an appeal from that decision by the Macon Construction Co., whose interests are represented by Mr. Sparks. At the hearing at Macon last week the counsel for the trust company withdrew the petition for the appointment of a co-receiver, but gave notice that it would be renewed at a later date. This leaves Mr. Sparks still in control of the management of the company's affairs.

Great Northern.—The Company reports for six months ending Dec. 31:

Gross earnings including proprietary lines		$9,197,040
Oper. expen., taxes and rentals		5,162,004
Net earn		$4,035,036
Other income		314,702
Total income		$4,349,738
Interests and guaranteed dividends	$3,155,418	
Dividends on preferred stock	562,500	3,717 918
Balance		$631,820
Net income of steamships (season 1893) and proprietary companies, other than railroads		267,373
Surplus		$899,193

Huntingdon & Broad Top.—The annual report for the year to Dec. 31, 1893, shows the receipts to have been $703,607; expenses, $334,419; leaving the net earnings at $369,419. The passenger traffic fell off slightly, owing to the dull times, the number of passengers carried last year being 101,749, against 107,248 in 1892. The freight tonnage, however, increased 235,326 tons.

Illinois Central.—The table below giving the net income from traffic for the six months ending December 31, 1893 and 1892, shows the following comparisons:

	1893.	1892.	Inc.
Miles operated	2,888	2,888	
Gross earn	$12,140,139	$10,194,361	$1,945,778
Oper. expen. and taxes	7,880,497	7,331,237	549,260
Net earnings	$4,259,642	$2,863,124	$1,396,518

Gross receipts from traffic for the month of January, 1894, are estimated at $1,488,925; the receipts for January, 1893, were $1,546,595, being an estimated decrease of $57,670.

Kickapoo Valley & Northern.—An application for a receiver for the above railroad and the United States Construction Co., which built the road, has been made in the Federal Court in Madison, Wis., in behalf of the Continental Trust Co. of New York, which holds $600,000 of the bonds. The road is now in operation from Wauzeka, on the Chicago, Milwaukee & St. Paul, to old iers Grove, Wis., 34 miles, and was built in 1892. The road has been operated by the United States Construction Co. E. A. Packer, 143 Liberty street, New York, is President.

Missouri, Kansas & Texas.—A circular has been issued by the company asking the stockholders to subscribe for $1,000,000 of bonds, now owned by the company, at 70 and accrued interest. The circular explains that the company needs about $700,000 to make necessary improvements, such as the laying of heavier rails, the building of new sidetracks, etc.

New York Central & Hudson River.—The gross earnings of this road for the month of January, 1894, were $3,171,096 as compared with $3,456,343 in 1893, being a decrease of $285,247. The mileage increased 238 miles.

Nicaragua Canal Construction Co.—John R. Bartlett, Chairman of the Reorganization Committee, reports that the holders of over 92,500 shares, or more than 75 per cent., of the stock have assented to the plan of reorganization, and that the holders of more than 75,000 shares have deposited their stock with the Central Trust Co.

Petersburgh & Asylum.—The Central Trust Co. of New York filed a bill for the appointment of a Receiver for this road at Petersburgh, Va., on Feb. 6. The line is only three miles long and connects Petersburgh with the Norfolk & Western. The company has a funded debt of $50,000, and the road has been open for about five years.

Philadelphia & Reading.—Negotiations were concluded last week for placing $6,000,000 coal trust notes of the railroad. With the proceeds it is proposed to pay off the Speyer loan of $2,500,000 and that made by the Finance Company of Philadelphia. The payment of the Speyer loan will release $5,800,000 of collateral trust bonds, which that firm holds as collateral for the loan. The railroad owes the Finance Company $3,000,000, in settlement of which the latter will take $2,000,000 of the coal trust notes and $1,000,000 in cash, leaving $500,000 of the new coal notes with which to pay off smaller obligations. The coal notes are based upon $7,000,000 of coal and coal accounts now in possession of the company.

Richmond & West Point Terminal.—Modifications in the reorganization plan have been announced this week. The amount of assessment on Richmond Terminal common stock will be reduced from $12.50 to $10, and for this assessment both bonds and preferred stock of the new company will be given. It is reported further that the amount for which the underwriting syndicate is to be liable has been reduced from $15,000,000 to $11,250,000, and that holders of Richmond & Danville debenture five per cent. bonds and of some other issues of the Richmond Terminal system, will be asked to fund some coupons.

Utah Central.—The State Court of Salt Lake City has authorized the Receivers, Clarence Cary, of New York, and James McGregor, of Salt Lake City, to issue $100,000 of receiver's certificates. About $28,000 of this amount is for claims due for equipment. The indebtedness of the road outside of its funded debt is said to be over $130,000.

Wilmington, Newbern & Norfolk.—The East Carolina Land & Railway Company has been formally consolidated with the above railroad. The extension of the Wilmington, Onslow & East Carolina, the former name for this road, to Newbern, N. C., was built under the charter of the East Carolina Land & Railway Company. This extension begins at Jacksonville, and is about 37 miles long.

The suit of the company against the commissioners of Onslow County N. C., for the first payment ($30,000 of the county's $60,000 subscription to the road will be heard at the next term of Superior Court in Lenoir County. This $30,000 was to have been paid upon the completion of the road from Wilmington to Jacksonville, the other $30,000 upon its completion to Newbern.

Windsor & Annapolis.—The stockholders of this company, at a recent meeting in London, ratified the proposed purchase of the Yarmouth & Annapolis road, formerly the Western Counties. This line extends from Yarmouth to Annapolis, 87 miles, and will give the Windsor & Annapolis a continuous line from Halifax to Yarmouth, where connection will be made with the steamship line to Boston.

Wisconsin Central.—President Abbot has informed the Merchants' Association of Milwaukee, in reply to a letter from that body, urging the extension of the road into Milwaukee, that when business activity and better times succeed the present depression, the company will resume its efforts to secure an independent entrance into that city.

TRAFFIC.

Traffic Notes.

The number of emigrants arriving at New York in January was 5,578, the smallest in any month for many years. In January last year there were twice as many.

A freight bureau has been organized at Galveston, Tex., by the Chamber of Commerce and other commercial bodies. Several large manufactories outside the city are also interested. The commissioner of the bureau is Mr. D. C. Imboden.

In Little Rock, Ark., one day last week the ticket brokers fought so sharply for St. Louis passengers that they finally gave them a free ride and a dollar for spending money. It appears that this was done by selling excursion tickets to Louisville by way of St. Louis.

The Kansas Railroad Commissioners have issued an order reducing the rate on coal from the mines in southeastern Kansas to Wichita from $1.90 to $1.35 per ton. This is the result of a long and bitter fight between the manufacturers in the interior towns and the railroad companies. It is expected that at least one of the four roads interested will refuse to change its rates.

Commissioner Goddard, of the Trunk Line Association, has authorized the Erie to reduce its rates on westbound freight five cents per 100 lbs. (first class—other classes in proportion). The differential, which has heretofore been on the basis of five cents less than the standard rate of 75 cents to Chicago, with corresponding rates to other points, is thus doubled. This action of the Commissioner is in accordance with the Trunk line agreement made last fall.

The New York *Evening Post* learns from the steamship agents in New York that the passenger business of the trans-Atlantic lines in 1893 was about 20 per cent. smaller than in 1892. Since last August the steerage travel has been heavier eastward than westward. So far as cabin passengers are concerned, the lines to England held their own, as compared with 1892. The agents estimate that eastward freight in 1893 decreased 25 per cent. and westward 45 per cent. Freight rates decreased 10 to 15 per cent.

The conference between the Interstate Commerce Commissioners and the traffic officers of a large number of prominent roads, which was held at Washington last Monday, to consider the best form of uniform tariff to be prescribed by the Commission, adjourned for a month, after considering the matter somewhat informally. Auditor McCain, of the Commission, presented as a basis of discussion a form, which he had made up, for a freight tariff over the Wabash Railroad from East St. Louis to Eastern points. The railroad men expressed a willingness to do everything possible to aid the Commission in its effort to secure uniformity; but pointed out the practical impossibility of printing an ideally perfect tariff.

Chicago Traffic Matters.

CHICAGO, Feb. 14, 1894.

The Federal Grand Jury called before them on Feb. 9 Chairman Blanchard, of the Central Traffic Association, and President Newell, of the Lake Shore. Chairman Blanchard was questioned regarding statistics and general matter, but little information was obtained. After a few preliminary questions asked of President Newell an adjournment was taken until this week. It is probable that Mr. Newell will refuse to answer the essential questions concerning rate-cutting on his road, and that the outcome of this inquiry will be similar to that in the Counselman case.

There is a strong suspicion that some of the Eastern lines are making a 20 cent rate, or rates approximating that figure, on corn to New York, notwithstanding the adverse vote taken in the Central Traffic Association last week on the proposition, and it would not be surprising if a 20-cent rate was openly quoted soon.

At the time the Western Passenger Association lines entered into the agreement to control westbound immigrant business through a clearing-house in New York the Union Pacific declined to become a party to the agreement, alleging as a reason therefor that its Receivers were opposed to becoming members of any association. Fears were entertained at the time that this action boded ill for the success of the agreement. These fears are now shown to have been well founded. At a meeting of the Advisory Board held Feb. 9 the Union Pacific formally demanded that it be allowed to sell prepaid orders independently of the association; that its contract with agent Fugazi be recognized and not interfered with; that its General Eastern Agent be given the same commission as allowed emigrant agents in the 1st ward; that all business handled by the Union Pacific be routed over its connections east of the Missouri, viz., the Chicago & Northwestern and Chicago & Alton. This last proviso alone, if conceded, would mean the failure of the plan. Apparently the only hope now for the continuance of the life of the agreement is that the Northwestern and Alton, who are both members of the Western Passenger Association, will demand of the Union Pacific that it modify its ultimatum.

The Atchison and the St. Louis & San Francisco have filed notices of withdrawal from the pass agreement, alleging that they have found numerous passes issued by their competitors in violation of the agreement. Chairman Midgley is making frantic efforts to get the offending lines to recall the passes, in the hope that if this is done the Atchison lines will cancel their notices of withdrawal. Opinion is about equally divided whether the agreement will stand or collapse.

The proposed eastbound freight and passenger agreements for the division of business are both "hung up" for the present, under various pretexts. When an attempt was made to confirm the action of the Joint Committee, it was found, as usual, that some of the lines in Central Traffic territory would not support the recommendations, and, more vital than this, that some of the lines now in the hands of Receivers refused to place themselves in a position of possible violators of the law. Meanwhile the roads are professing great virtue and say they are scrupulously maintaining rates; and the big shippers look wise and say nothing.

Chicago shippers are still agitating the subject of a complaint to the Interstate Commerce Commission against the uniform bill of lading, and say that the complaint is now being formulated. The latest specific grievance is a notice from the Western lines that iron and steel articles to and from Central Traffic territory must be shipped subject to the uniform bill of lading and the official classification. The Chicago *Herald* is now turning its attention toward securing a uniform classification in connection with a uniform common-law form of bill of lading, and has recently published interviews with prominent shippers and railroad officers in support of such action. The present system is peculiarly hard on Chicago shippers and roads for the reason that this is the dividing line between the two classifications. All the Western lines and a large number of Eastern lines favor the merging of the two classifications in one, and the only objection now appears to be that of one or two Eastern lines that such action will make it necessary to raise some rates which by usage they claim to have become material factors in the ratemaking situation.

The shipments of eastbound freight, not including live stock, from Chicago, by all the lines, for the week ending Feb. 10 amounted to 47,539 tons, against 43,722 tons during the preceding week, an increase of 3,817 tons, and against 71,333 tons for the corresponding week last year. The proportions carried by each road were:

Roads.	W'k to Feb. 10.		W'k to Feb. 3.	
	Tons.	P. c.	Tons.	P. c.
Michigan Central	5,035	10.6	4,160	9.5
Wabash	2,968	6.3	1.818	4.2
Lake Shore & Michigan South.	8,371	17.6	7,481	17.1
Pitts., Ft. Wayne & Chicago	5.445	11.5	5,188	11.9
Pitts., Cin., Chicago & St. Louis	7,731	16.3	7.336	16.8
Baltimore & Ohio	2,792	5.9	1,749	4 0
Chicago & Grand Trunk	3,313	6.9	3,364	7.7
New York, Chic. & St. Louis	4,518	'9.5	4,886	11.1
Chicago & Erie	5,529	11.6	6 155	14.1
C., C., C. & St. Louis	1,837	3.8	1,582	3.6
Totals	47,539	100.0	43,722	100.0

Of the above shipments 3,975 tons were flour, 16,729 tons grain and millstuff, 9,233 tons cured meats, 10,251 tons dressed beef, 1,398 tons butter, 1,497 tons hides and 2,663 tons lumber. The three Vanderbilt lines carried 37.7 per cent., the two Pennsylvania lines 27.8 per cent.

(Other Chicago traffic news will be found on page 119).